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The Liverpool Cathedral Scheme.

THE collection of drawings which is now on view in Liverpool will, we think, satisfy the most previously sceptical persons that there are great possibilities in the site which has been selected, and which we have always said was the best, taking architectural and practical considerations together, among such of the possible sites as have been suggested and discussed. Two sites have been suggested which would have been superior in an architectural point of view. One was that of a river site on the quays; an idea which architecturally was calculated to excite the wildest enthusiasm, for a building of the highest class would have produced an effect, in such a position, almost unrivalled. Practically, it would have been rather out of centre; and it appears that the space was not to be had, being wanted for other purposes. The other suggestion we refer to was that of Mr. Seddon, which was strongly supported by some gentlemen in Liverpool who took a warm interest in the subject, that the new cathedral should be placed with its western façade on the line of street called Commutation-row, rather above and facing St. George's Hall. This idea was illustrated in our pages about a year ago, by a drawing specially made by Mr. Brewer (*Builder*, Feb. 14, 1885), showing the façade of Notre Dame at Paris, with spires added, as it would appear in that position. That this site would be architecturally superior to the one selected there is no doubt. The cathedral would have been less cramped, and would not have interfered with the view of St. George's Hall from any point. It is all built over, however, and we presume that the cost of acquiring the property and paying compensation would be very considerable. The idea, however, may still be worth keeping in mind.

The site selected (or at present to be regarded as selected), west of St. George's Hall, and now occupied by a church of little architectural interest, and its church-yard, is somewhat cramped, and in shape and proportion it is not very well suited to the usual Mediæval type of cathedral plan. But it is what may be called a rather suggestive site. Its very shape, rather wide than long, appears to suggest a departure from precedent in planning, or, at least, from the precedent usually accepted in modern English churches, that of the long and narrow Mediæval nave. Such a departure we should regard, if fitly carried out, as a distinct gain. We have no wish to see a nineteenth-century cathedral built as a mere reproduction of the main features of a thirteenth or fourteenth century one. The temptation to take this course, considering how the Mediæval cathedral is endeared to us by association, is no doubt very great; but modern church worship, unless from the point of view of a small section of Churchmen who are as archæological in their religion as in everything else, is essentially different from Mediæval church worship; and it should be the business of a modern cathedral architect to produce a fine building which may at the same time express the feeling and the requirements of modern worship. The site selected for the Liverpool Cathedral gives him a natural lead in this direction, since it is too short for the Mediæval type in its full proportions. The great fall of the ground towards the west is another of the suggestive incidents in the site; it creates a difficulty in some respects, but it almost compels a bold and effective treatment of the western façade. The principal drawback is the too close proximity into which the east end of the cathedral will necessarily be brought to St. George's Hall, and the stopping out, to a great extent, of the view of the west flank of that building. If we remember right, the opinion was advanced by some one, in the multitude of discussions which have taken place on the subject, that the obscuring of the said west flank would be no loss; but that shows a very inadequate appreciation of Elmes's building. St. George's Hall is, of course, a building most unsuitably designed and planned for its purpose; its value now is mainly as a modern treatment of Greek materials; but in this respect the western colonnade, with its square columns and its screen,—Greek in detail, Egyptian in arrangement,—is one of the most original and effective portions of the design. It will not be entirely shut out by any of the cathedral designs submitted; but its continuity and perspective will be much abbreviated.

Considering all these conditions: the squareness of the site, the proximity of a great modern Greek building, the Classic tendencies of the principal surrounding buildings, our own idea, as we have before indicated, would have been a design based on the suggestions of Wren's first design for St. Paul's, with a great dome and a wide central area, approached by a *pro-naos* rather than nave; the dome space itself forming the *naos*, or the chief part of it. The opportunity of realising Wren's fine conception, never (to his grief) carried out, with finer and purer treatment in detail than Wren's pseudo-classicism can be accounted, struck us as what might be regarded as a godsend to inspired architects, anxious for a new path to fame. *Dis aliter visum;* the selected competitors think otherwise. Messrs. Bodley & Garner give, as a distinct reason against a Classic treatment, the consideration that a Classic cathedral would not detach itself sufficiently from its surroundings. "There is great danger," they say, "that a group of buildings, arranged as they must be very closely, and designed in the same style, should be confused together. The cathedral must, of course, be the most important in every way, but it would not occupy the place of honour, which is already taken by St. George's Hall; and we think that it would be difficult, if not impossible, to prevent the latter appearing a part of the former. Of course the group would, architecturally, be very fine." Surely the admission in the last sentence is important enough to outweigh the previous considerations; but the argument is altogether a curious instance of the difference between architecture now and architecture when the Mediæval cathedrals were built. Then, the cathedral was naturally in the same style as any buildings adjoining it, and there was no fear about their being "confused together." It must be admitted, however, that in the present state of ecclesiastical feeling it is probable that cathedral architecture founded on Classic models would have little chance of acceptance, and one cannot expect competitors to overlook that factor in the case.

The three designs by the architects invited to compete, Messrs. Bodley & Garner, Mr. Brooks, and Mr. Emerson, have each distinct individuality in the way in which the building is treated. Mr. Brooks selects the style of the latter portion of the fourteenth century, as illustrated in such buildings as Beverley, Fountains, Lincoln, &c., both as free from the more elaborate detail which might be injuriously affected by the atmosphere of a city like Liverpool, and also because the more severe detail of this comparatively Early Gothic style harmonises better with the lines of the Classic architecture adjoining: which is perfectly true. The plan is the Mediæval plan pure and simple, with the square crossing at the intersection of nave and transepts, only that the choir is shorter than the typical Mediæval choir (which is, of course, quite in keeping with the purposes of a modern cathedral), and the nave is short for its height and the scale of the building; but this is inevitable from the conditions of the site. The principal external effect is concentrated on the west end, where are two lofty towers with spires, set out north and south beyond the line of the aisles, and having between them a great flight of steps leading into three deeply-recessed and cavernous porches, Continental rather than

English in character. This is a grand and monumental piece of architectural composition, the whole width of the towers flanking the steps and forming an *appui* for the triple porch: one bay of the nave arcade is sacrificed for it, but the effect is worth the sacrifice, and the alternative design showing a side access by flights of steps entered through the towers, and giving an additional length to the nave within, is far inferior in effect, and not to be thought of in comparison with the other treatment. The nave piers are very lofty; the main line of the piers runs right through the ground-floor arcade to the springing of the triforium arcade, which thus becomes in reality the main arcade, giving a great look of height to the nave; at the same time the piers are gripped and steadied in the centre of their height by the lower tiers of arches and the floor of the triforium, which is not a mere arcaded passage, but a great gallery as large and lofty as the ground-floor aisles. The centre external feature is a lantern only, an octagon with turrets at the angles, and entirely subordinate to the western towers. The eastern termination is a semicircular apse, which, as Mr. Brooks says, "gets over the difficulty which might arise from the awkward line which might be produced by a square-ended building in close proximity, but not at right angles with it"; and we may add that, the northern termination of St. George's Hall being semicircular, we get here the interesting incident of the juxtaposition of the Gothic and the Classic apse. The general style of the design is such as we are all familiar with already in Mr. Brooks's work; broad masses of masonry in the walls and buttresses; simple and severe treatment in the windows and other details; an entire absence of anything like trickery or mere prettiness; these are the qualities we all know in Mr. Brooks's churches, and they are equally manifest in this, the largest design he has ever made.

These characteristics will be apparent in the perspective view of the exterior, which we publish this week; but we are not professing now to do more than give a general idea of the characteristics of the three designs, reserving more detailed comments for future numbers, when we shall give further illustrations of each design. Messrs. Bodley & Garner adopt a rather later Gothic style, that of the Early Decorated period, with geometrical tracery. Their design is pure English Gothic, and remarkable for grace and elegance externally. In the plan they have adopted the fine expedient which distinguishes Ely Cathedral, of the expanded octagonal space at the crossing; but, in place of being content with a mere lantern over it, they have raised the centre feature into a great octagonal tower in two stages, crowned by a spire, the whole rising to a height of about 450 ft. The west end has two towers with spires, about 270 ft. in height, the idea being to repeat on a larger scale the composition still existing at Lichfield, and which was intended and perhaps originally carried out in other English cathedrals. The internal arcades are of great mass and solidity, as will be evident from the view of the interior which we give in this number; the authors observing in their report that in a modern cathedral the question of the convenience of seeing and hearing in the side aisles need not be taken into account, as the centre aisle alone is likely to be used for actual worshippers, the side aisles being for passage and for the reception of monuments. They "think it desirable to insist on the absolute necessity of a very large space for this purpose, as the number of memorials becomes so very greatly increased in the course of ages that, unless there is very considerable room left, the church becomes greatly encumbered and disfigured." The authors consider that the building approaches too closely to St. George's Hall, and wish that the site should be somewhat extended westward; or they suggest that more space may be gained by reducing the scale of the building, without alteration of the design. To our thinking, this might be done even with improvement to the design; for the fact is the scale of the parts is rather over-large, and the design, in the geometrical elevations, does not convey the idea of its actual size. With the exception of the very original and bold treatment of the central feature, this design is an orthodox English Gothic one of very pure type, and if this be the object it could not be more completely carried out. Mr. Bodley has in former times designed churches, like that at Tue-brook, near Liverpool, of which it might be said that when the hand of time has passed over them, it might become very difficult to say whether they were genuine Mediæval work or modern reproductions, so completely has the spirit of Gothic been mastered in them.

Mr. Emerson's elaborate and masterly report is a complete essay on the architectural function of the cathedral, illustrated by a number of small views of various cathedrals, and of cities with their cathedrals, showing how the great building takes its place in relation to the whole aggregation. To this we shall hope to do full justice at greater leisure. Here we can only mention generally that Mr. Emerson considers that the spirit of modern worship demands an area as unbroken as possible, and every facility for congregational worship. He adopts a plan based on the Mediæval division into centre and side aisles, nave and choir, but employs a rather short nave and a very large octagonal centre space at the crossing, covered by a large dome. In regard to the dome, Mr. Emerson remarks that the cathedral of a great city requires something more massive than a tower and spire to assert itself in the general view, and illustrates his point by views of the domes of St. Peter's and St. Paul's with a portion of the city adjoining, and a general view of Florence showing the mass of the dome as the central and conspicuous object. The argument may be pressed too far, but there is certainly something in it, and as to the suitability of a dome as the central feature for this special site, we have already expressed ourselves to the same effect. In regard to style, Mr. Emerson adopts, as he says, an early phase of Gothic, bordering on Romanesque; but, as will be seen from the view we give, it is Gothic "with a difference." There are reminiscences of India about it, with which country the author of the design has been much connected architecturally. The treatment of the west entrance, however, is derived from Peterborough, and certainly no finer model could be taken. The great porches are flanked by western towers, which Mr. Emerson, like Mr. Brooks, sets out beyond the line of the aisles, to give greater breadth to the front. In spite of the Gothic or quasi-Gothic detail, the main lines of the design, except the towers, are rather Classic than Gothic, and partly suggest a regret that the whole building was not frankly Classic. This, however, is only a passing impression, which may be modified on the more careful consideration which the boldness and originality of the design certainly call for.

We have confined ourselves purposely, as we have implied already, to giving a general idea of the *motif* of each design, with a typical illustration of each; reserving more detailed consideration of them. Their authors will not quarrel with us for thinking that their labour of months is not to be fairly dissected, criticised, and disposed of in a few hours.

The Proposed School of Forestry in Edinburgh.—The Report of the Select Committee on Forestry states that it was found impossible to conclude investigations during the past session, and recommends that a committee on the subject should be appointed in the next session of Parliament. On the general subject of the proposed Forest School, Colonel Pearson, in examination before the committee, expressed himself in favour of a Chair of Forestry at the Edinburgh University, but he further stated that he had no actual faith in lectures in the school unless illustrated by practical instruction. Regarding the extent or scope of the school, Mr. Thiselton Dyer, in reply to Sir Edmund Lechmere, said he would make the school applicable to India and the colonies as well as to our own country.

AMERICAN PLUMBING: SANITARY SPECIALITIES.*

BY AN AMERICAN ARCHITECT.

Plumbing Fixtures.

SINKS, bath-tubs, water-closets, wash-basins, &c., are called with us plumbing fixtures.

Water-closets are generally a copy or at least of the same class as closets in the old country (England). The Bramah, the Jennings, the Brighton, and hopper closets have their counterpart in this country, varying only in slight and unimportant details. Closets in which the discharge is caused by syphon action are novelties which the United States have produced.

The Dececo was invented by Geo. E. Waring, jun. The Tidal Wave and Cascade

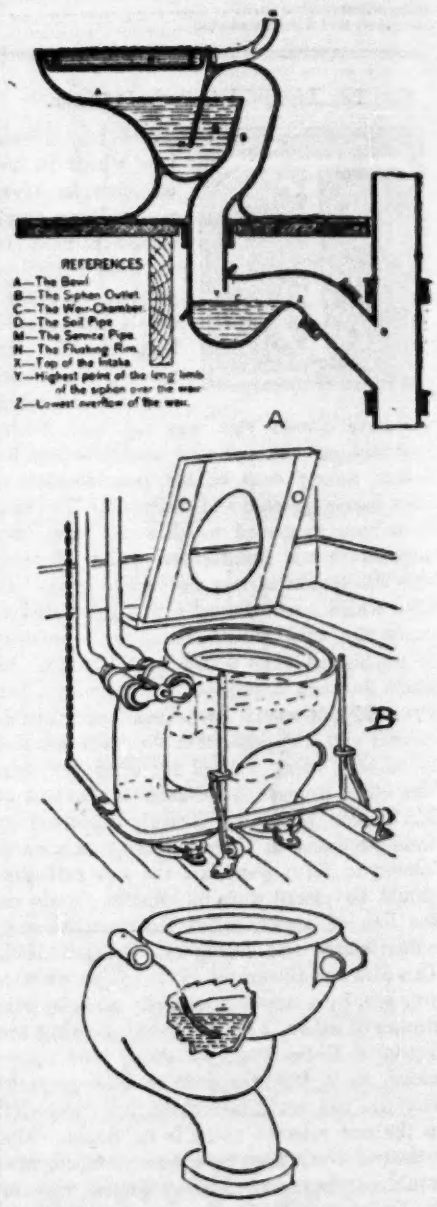

Fig. 8.

A. The Dececo. | B. The Tidal Wave. C. The Cascade.

were invented by J. E. Boyle. They are emptied by syphon-action. The Dececo (fig. 8, A) has a very sharp water seal at the bottom of the bowl. The closet is set over a weir placed beneath the floor. The first discharge fills the weir to the partition, when the outlet forms the long arm of a syphon. In this way the contents of the bowl are syphoned every time the bowl is used. From its shape it is necessary that this closet should be filled to within a short distance of the top of the bowl before the necessary syphon-action that empties the closet can take place.

The weir-chamber below the floor is very

* Continued from p. 6.

much like the objectionable English D-trap in form. There is no opportunity for a vent-pipe in the trap of the Dececo, as it would prevent the syphon-action. This closet is, however, neat and cleanly, and is manufactured in one piece of earthenware.

The Tidal Wave has a double trap. An air-pipe runs from the space between the traps, up and through the tanks that supplies the closet with water. This air-pipe is governed by a valve which opens only when acted on by a pressure from below. In this way the vent-pipe does not interfere with the formation of the vacuum necessary before the closet could be operated by syphon-action. When two-thirds of the service-box has run off, the vacuum is broken, and the remaining third of the water fills the bowl, and leaves it in proper form to be again discharged by the syphon. The bowl (see fig. 8, B) and its double traps are formed

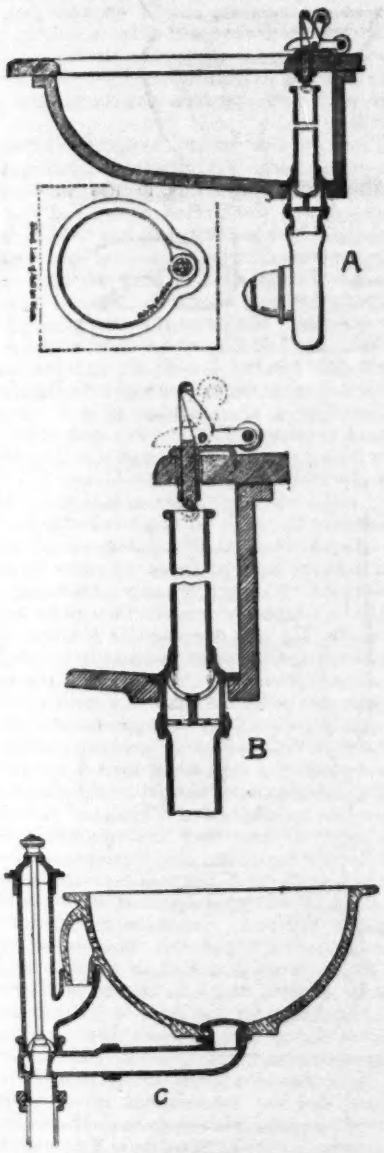

Fig. 9.

A. and B. The Sanitas.
C. J. L. Mott's waste and overflow.

in one piece of earthenware. The lower trap is ventilated, or has a place for connexion with a vent-pipe at the usual place. The closet must be supplied from one of Boyle's patent tanks or cisterns.

The Cascade Closet (fig. 8, C) is a modified form of the tidal-wave closet. The outlet is directly beneath the centre of the bowl. The closet does not require as much space, and can be set so as to face in any direction.

In practice, it is found to be an excellent form of closet. This closet requires a trap beneath the floor, and the joint between it and the closet must be absolutely tight, or the closet will not operate.

It is fast becoming a common practice in this country to dispense with all wooden panelling, boxing, and casing around water-closets, bath-tubs, and wash-basins.

The water-closet seat rests on brass, nickel plated, or iron legs, leaving the closet visible, and allowing no concealed or dirty places to exist. In the best work the floors and sides of the bath-rooms are cased with glazed tile; and the room is kept warm by the furnace, hot-water, or steam heating apparatus. Bath tubs are put on legs when made of iron or porcelain, and make a sanitary tub.

Bath tubs in the United States vary little from bath tubs in England.

The market is supplied with tubs made in sheet copper tinned, iron (plain, painted, zinc coated, and enamelled), and in solid porcelain. The copper tubs, being the cheapest, are the most generally used.

They come tacked into a wooden form or box. This kind of closet requires a wooden casing to make it presentable.

The overflow runs into the waste-pipe on the tub side of the trap. As a sediment collects in this concealed overflow, a standing overflow is now used sometimes, similar to the overflow shown in the "Sanitas" wash-basin (fig. 9, A and B). Baths are invariably supplied with hot and cold water.

Wash-basins are simple bowls, the overflow connecting with the waste-pipe just above or between the bowl and the trap. There are numerous patent overflow and waste pipes, but

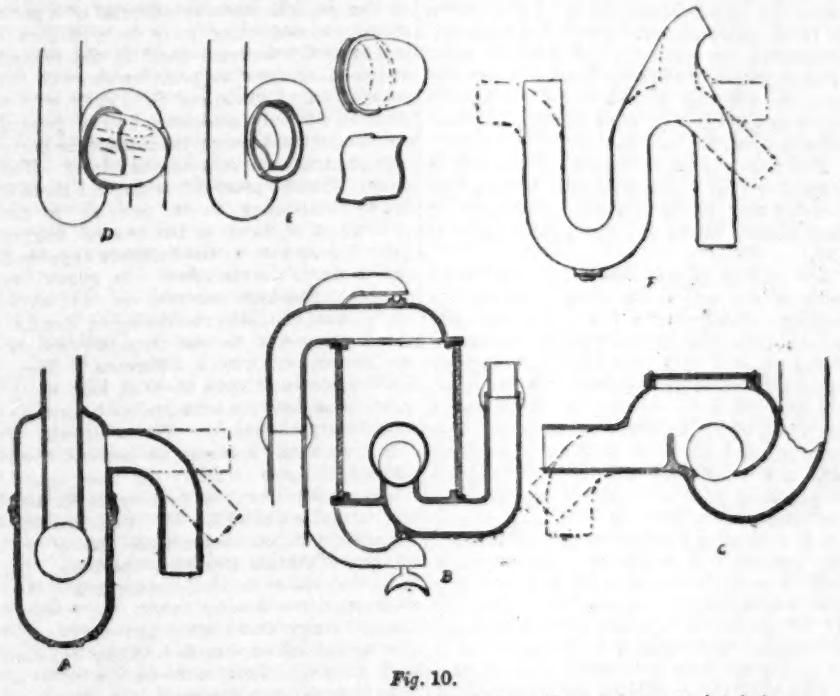

Fig. 10.

A. Bower's trap.
B. Bennor's trap.
C. Cudell's trap.
D. Sanitas trap.
E. Sanitas, with cup and separater detached.
F. The common O-trap, with vent attached. The dotted lines show the different forms in which it may be obtained.

they have been but little used in practice. I illustrate two of the most simple and best patented devices which are finding their way into use (see fig. 9).

The Sanitas basin (fig. 9, A and B) has a standing overflow which forms the plug for the waste-pipe of the basin. By this contrivance the concealed overflow, as well as the common plug with its dirty chain, are removed. The plug or overflow can be easily removed and cleaned. It is raised or lowered by the small lever shown in the detail cut. The J. L. Mott basin illustrated (fig. 9, C) also has its overflow through the plug, but in getting rid of the chain, a part of the waste-pipe and the overflow are left to collect sediment. There is little opportunity of cleaning them as they are concealed.

The same firm manufacture an oval basin designed to allow greater freedom in the use of the arms in washing the face and neck.

Kitchen Sinks are used of iron (plain, painted, galvanised, and enamelled), steel, and porcelain. Zinc-coated, or galvanised iron as it is called, is the kind most commonly used in this country. They vary in size from 12½ in. by 16½ in. to 20 in. by 48 in. Solid porcelain sinks are used in the fine houses, but are too costly for houses of moderate price.

Hotels and large residences have or use grease-traps beneath the kitchen sink. These traps are put in beneath the sink to catch the grease from the kitchen utensils and dishes and prevent it from passing into the sewerage system. It is liable, on reaching the cold pipes, to congeal and give considerable trouble. The majority of them are merely large catch-basins, but Tucker's grease-trap is surrounded by a cold compartment, so the fatty matter will be quickly cooled and deposited. When full, the compartment can be lifted out and the grease removed. Commonly the simple O-trap is used.

Pantry Sinks are commonly made of planished copper, but in fine work solid porcelain is sometimes used. From the danger of breakage it is questionable if the copper sink is not the best for the purpose, although the porcelain ones are the most easily cleaned and the most pleasing to the eyes.

Urinals vary little from those used in England. Lipped urinals are the most common as well as the most desirable form. The most desirable method of flushing them is from a tilting tank, which empties its contents every time it fills. The length of time it takes to fill is governed by the supply-cock. It can be made to empty once every hour or once every day. Urinals are rarely used in private houses. Closets, protected by porcelain safes, or so arranged that all the wood-work can be lifted from the bowl, are used in dwellings in the place of urinals. Urinals proper can only be found (with a few exceptions) in hotels and railway stations. In them a constant stream of water is kept running.

Tanks or Cisterns.—The plumbing regulations in a majority of the American cities require the use of separate tanks to supply water to flush the closet. This is a sanitary regulation to prevent the direct connexion between the water-supply main and the closet. Water has been known to have been drawn from the closet at a faucet opened below. There are tilting and syphon tanks, lever, plug, and service-box tanks, waste-preventing plugs, and service-boxes; in fact, hundreds of tanks differing slightly from each other, about the same kind and style as in England. They are manufactured of iron, lead (sheet and cast), and copper. Wooden lead-lined tanks have less resonance, and thus make less noise when water is discharged from them than do iron tanks. For this reason they are again coming into use after having been totally abolished for iron tanks.

Space does not allow for illustration and description of the different varieties of tank;

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suffice it to say, that a before-and-after wash-tank is usually the kind adopted. The before-wash moistens the sides of the bowl, and prevents the adhesion of fœcal matter. The after-wash carries everything through the trap into the sewer. The before-wash is produced when the seat is pressed down, and the after-wash is brought into play when the seat is relieved of pressure.

Traps.—Between water-closets and the soil-pipe, 4 in. or 3¾ in. S or V traps are invariably used in the United States. The trap is porcelain, and forms a part of the closet in a large number of cases. When made in connexion with the closet, it sets above the floor.

The traps placed beneath closets are like the illustration (fig. 5 C, p. 5 *ante*). Under sinks, bath tubs and wash-basins, and laundry tubs, 1¼ in. or 2 in. S or V are usually used (see fig. 10, F). Plumbing regulations require these traps to be ventilated. Grease-traps are rarely put under kitchen sinks, except in large public houses. A number of patent water-seal and mechanical traps are used to a greater or less extent under basins, baths, &c. I illustrate the kinds which have had or are having the most extended use.

The large English D and pot traps are never used in this country, as they are supposed to accumulate and retain waste matter instead of discharging it into the soil-pipe. Not many years ago it was common to placed leaden S traps under closets. As it was a common occurrence for servants, and possibly other careless people, if the traps became in any way clogged, or if they wished to get any uncommonly large object through the trap to punch holes in them with sticks.

For this and other reasons mentioned in connexion with leaden pipe, iron traps are invariably used under closets. Small traps for wash-basins, baths, &c., are usually made of lead.

The subject of trap ventilation has been a bone of contention for some years in this country. Sanitarians a few years ago were unanimous in their advocacy of trap ventilation. It was claimed that thus trap syphonage, or the destruction of the water seal, was prevented, whether caused by vacuum, or momentum of the water, or by back-pressure of gases. This was supposed to have been an undisputed fact, and municipal plumbing regulations have invariably inserted a clause requiring trap ventilation. Mr. Geo. E. Waring, jun., and Mr. J. Pickering Putnam claim that it is not only useless, but wrong to ventilate traps. Both these have monetary interest in appliances which do not require ventilation, the sale of which is injured by the aforesaid regulations. This creates a natural doubt in the minds of those interested, unfortunately, for fear that their opinions are unknowingly biassed by their pockets. E. S. Philbrick, Dr. John S. Billings, Henry C. Meyer (editor *Sanitary Engineer*), and others, assert that trap ventilation is the proper thing.

I am now carrying on an exhaustive series of experiments to determine these and other disputed questions in plumbing, under the auspices of the Museum of Hygiene, United States Navy Department.

The traps illustrated in fig. 10 are the different kinds usually used in connexion with wash-basins, bath tubs, and sinks.

The simple S and V are the kind most generally used, made of lead (fig. 10). As shown in the illustration, the vent-pipe is enlarged, so no deposit can take place in it.

The "Sanitas" trap is professedly anti-syphon. It consists of an S trap, with a glass compartment and separator let into the side. This trap holds quite a body of water, and the waste water has a tortuous passage in 'going through it (fig. 10, D and E).

The "Bower" is a mechanical valve, the ball being presumably able to resist any back pressure of gases. The ball floats. The bottom of the trap is glass, so any collection of sediment can be easily seen and removed.

The "Cudell" and "Bermor" traps both have a ball valve that takes its seat by gravity. The illustrations show their form and mechanism. They are easily taken apart, and the inside is always visible.

The tendency now is to use simple S traps, making them as small as the waste-pipe; in some cases smaller. The manufacturers are now making the outlets from wash-basins, bath tubs, &c., as large as the waste-pipe, so the pipes and traps will be efficiently scoured by the action of the water. This completes a running account of American methods of a house sewerage system. Glenn Brown.

PROTECTION FROM LIGHTNING.

About two years ago we drew attention to this subject,* and pointed out the urgent necessity for a more general system of protection than exists in this country, and as we have reason to fear that very little improvement has taken place since that time, we are glad of the opportunity of the publication of a new edition of Mr. Anderson's work on "Lightning Conductors"† to revert to the same topic. The summer of 1884 pointed the moral which we attempted to draw in a very striking manner, for the records which Mr. Symons collected show that in the months of July, August, and September of that year no less than twenty churches, one hundred and twenty-two houses, twenty-one barns or sheds, forty-two chimneys, and eleven factories were struck by lightning in the British Isles, the damage being estimated at over 10,000*l*. It is somewhat surprising, and not altogether creditable, that such a state of things should exist at a time when we are congratulating ourselves upon the enormous advance that has been made in electrical science, which is undoubtedly the most striking feature in the scientific history of the last few years. Notwithstanding all this, one cannot fail to be struck with the thinly-veiled spirit of fatalism which characterises all accounts of lightning accidents which are given in the public press, showing that the public mind needs a very considerable amount of awakening on this subject. It is not too much to say that every account of damage to a building by a stroke of lightning might justifiably be followed by the words printed in large type,—"This accident might have been prevented"; and no opportunity should be lost of insisting upon this truth until its general acceptance becomes assured.

The work under notice is a very full, clear, and withal extremely interesting treatise on the subject of lightning-rods, giving the history of their invention and gradual spread, with a *résumé* of the scientific principles upon which their proper action depends. Since the systematic study of meteorology has been scientifically carried on, we have been able to gain a tolerably clear knowledge of the nature and formation of thunderstorms, but we are still only on the threshold of our knowledge of one of the greatest mysteries in nature, viz., the magnetism of the earth, which modern investigations show to have a very potent influence upon all terrestrial phenomena. The magnetism of the earth is constantly changing in intensity, and every now and then great magnetic storms take place, the cause of which is still quite unknown; but these storms are attracting the close attention of scientists in various parts of the world, and the observed facts seem to point to a close connexion between them and the condition of the sun. Whether fuller data will show any connexion between the occurrence of a thunderstorm at one particular spot and the magnetic condition of the earth at the same place, cannot yet be decided, but it is quite possible some such connexion may be found to exist. Records have been kept at various stations showing both the hour of the day and the season of the year when thunderstorms are most frequent, and it is proved clearly that they occur chiefly during the time when moist, warm, currents of air are ascending from the ground. For instance, in south-eastern Europe thunderstorms chiefly occur in summer between noon and five p.m., whereas in Iceland they are winter and nocturnal phenomena. It is certain that, the earth being a great storehouse of magnetic energy, the minute particles of vapour which are carried up by the ascending currents of moist air are charged with electricity, and these combine to form electrically charged cloud masses. The tendency of electricity is to accumulate on the surface of any conductor, and when thus accumulated, a charge of the opposite kind of electricity is induced on the surface of any other conductor within range, and thus the electricity of the clouds is frequently discharged between themselves. When, however, the clouds lie low, they and the earth react upon each other, the cloud being drawn down towards the earth, and the electrical density on the approaching surfaces of each increasing every moment until it becomes so great that the dielectric between them, *i.e.*, the air, is ruptured and the lightning flash occurs. The opposing electricities are endeavouring to get at one another, and if an easy path be offered to them they will take it quietly, and there will be no disruptive discharge. The true object of a lightning-conductor is to afford this easy path between the earth and the cloud.

There are two general systems adopted for the protection of buildings from lightning, that of Gay-Lussac, which is in use in France, England, and the United States, and that of Melsens, which is chiefly employed in Belgium. The former consists in the use of a small number of conductors of large sectional area, the rods towering above the topmost point of the building; the latter is on the principle of covering the building with a number of rods of small size forming a network, each rod being connected with each other and with the earth.

The French Government have instituted several inquiries into the protection of buildings from lightning, the first of which resulted in a report drawn up by Gay-Lussac in 1823, and, with few modifications, this still forms practically the basis of the whole science of lightning-rod construction. A careful abstract of this report is given in an appendix to Mr. Anderson's work. The only real point in which Gay-Lussac was in error was in his over-estimating the area of protection of a rod. He considered the protected space to be a cylinder whose radius was twice the height of the rod. Experience has shown that this must be very materially reduced, and the generally-received opinion is that the space protected would be represented by a cone whose apex is the point of the lightning-conductor, and the radius of whose base equals half the height of the rod. This space is less than that quoted in the report of the Lightning Rod Conference, where it is laid down that the radius of the base of the cone of protected space is equal to the height of the rod; but there was evidently some hesitation about this recommendation, and we are of opinion that, if absolute safety is to be ensured, this rule should be altered. The best shape for the point of the terminal has been the subject of much discussion, but as experiment and observation have both shown that the action of a stroke of lightning is distributed and not concentrated in one point, the modern practice is to supersede the original one terminal point by several small ones in the form of an aigrette. M. Melsens goes much further than most electricians in multiplying his terminal points. He covers his roofs with a network of wires with terminal aigrettes at every pinnacle and projection, and at several points along the ridge, all connected together, and practically forming a closed circuit. On the Hôtel de Ville at Brussels there are over 500 clusters of points. Of course, if all these wires, &c., were of copper, the cost would be very great; but M. Melsens claims that by using iron wire of about 6 millimètres diameter, he very much cheapens the cost of protection, and we are sorry Mr. Anderson did not give some further detail on this point. Of course where cost is not an object of consideration copper wire or tape is the best bind of conductors that can be used; but as copper is about ten times as expensive as iron, it is too costly an article for use on a large number of buildings that specially need protection. And although copper is a much better conductor of

* See the *Builder*, January 26, 1884.

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electricity than iron, yet as the specific heat of the two metals is approximately the same, copper of equal conductivity is heated more than iron because of its smaller mass per foot run. M. Melsens' experiments have proved more than this, for he has shown that if a powerful current of electricity be passed through wires of copper and iron one-tenth of a millimètre in diameter, the iron will stand while the copper will be fused. For this reason it is not wise to use copper of less than three-eighths of an inch in diameter; but M. Melsens uses iron wire of about a quarter of an inch in diameter with perfect safety.* It used to be considered that prominence was the special element of danger to a building, but isolation is equally so, and the probability is that a small farm-house or barn standing by itself in a hollow, especially if the neighbourhood be damp, is specially liable to be struck. The cheapness of the Melsens system is its great recommendation, and the inventor has published details of cost which show that small buildings can be efficiently protected at a cost of about 2d. per square mètre of surface, while the elaborate system adopted at the New Palais de Justice in Brussels cost only 6½d. per square mètre.

Whatever system of protection be adopted, there are three points of absolute importance:—(1) That conductors should be continuous for their entire length; (2) that all prominent masses of metal in a building should be brought into connexion with the conductors; and (3) that the conductors should have ample communication with damp earth. The first condition of continuity is, perhaps, best fulfilled by using the solid copper tape which was invented some years ago, and which is made in lengths of from 200 ft. to 400 ft., according to its weight per foot. When joints are necessary, it is not sufficient that the two adjacent ends of the rod should merely touch,—which state of things has been responsible for many accidents,—but the ends should be placed in close contact for about 6 in., and, in the case of circular rods, if the contiguous ends are filed so that the surfaces in contact are square so much the better; they should then be bolted together and covered with a mass of pewter solder. The second condition of safety is to connect all prominent masses of metal used in the construction of a building with the conductor, and it would certainly be better that the connexion should be at two points. This condition was not laid down by Gay-Lussac, because iron was not largely used in buildings at his time, but if the metal in a building be not connected with the conductor it is extremely probable that even if a portion of the lightning discharge takes its proper course, part of it may leap across from the conductor to the metal and do considerable damage. The third condition of adequate earth contact is the most important of all, and has been the most neglected. It has been stated that in order to transmit to moist earth an electric current with no more resistance than it meets with in traversing an iron rod of one square centimètre sectional area, the earth contact ought to consist of an iron plate 492 yards square. Of course, these theoretically perfect conditions cannot be practically complied with, but it should always be borne in mind that the superficial area of the underground portion of the conductor should be made as large as possible, and that in dry localities some artificial means of keeping it damp should be resorted to. Several means of securing extensive contact with moist earth are described by Mr. Anderson. In towns the gas and water mains afford an excellent earth, and it is calculated that by this means the earth contact of the conductors fixed to the Hôtel de Ville at Brussels is no less than 330,000 square yards. In country districts where mains are not available the conductor should always be laid in a trench and packed round with broken coke or charcoal, and should terminate if possible in a pond or some running water. It should never be forgotten that an artificial stone tank or reservoir is not an earth at all.

Now, if the carrying out of certain well-known conditions will ensure the safety of a building from lightning strokes,—and, apart from scientific testimony, the fact that many manufacturers are willing to guarantee the security of buildings fitted by them with lightning rods, is fairly good evidence that this is the case,—what is the cause of so many accidents occurring to buildings even when they have been furnished with rods? Simply that no systematic arrangements exist in this country for periodically inspecting and testing lightning-rods. Mr. Anderson lays great stress upon the necessity for this regular inspection, and it is impossible to insist upon it too strongly. We do not believe that any conductor which has been fixed for five years, and not inspected and tested in the meantime, would be found perfect at the present moment. The conductivity of a lightning-rod may be impaired in many ways. A lightning stroke may have passed harmlessly and yet have caused damage to the pointed terminals. In the case of iron, rust may have corroded the points. Artisans at work on the roof may have carelessly cut off the connexion with the gutter and other ironwork; new metal-work may have been introduced in such a way as to offer a readier path for the electric current than the conductor itself; alterations in the drainage of the neighbourhood may have converted a good earth into a bad one,—these and a thousand other simple accidents may have completely altered the conditions which existed at the time when the rod was first fixed, and it may often happen that these alterations cannot be discovered by mere inspection, but only by a test conducted by an experienced investigator, with the help of a galvanometer. Both the continuity of the conductor and the earth resistance should be tested, and the accurate determination of the latter is sometimes a rather complicated piece of work. What is the maximum earth resistance compatible with safety is a moot point. Mr. Anderson says that in France a resistance of 25 ohms is considered safe; but a correspondent of the *Electrician* says that we ought never to be satisfied with a higher resistance than 2 ohms in dry weather, and in most cases it would not be difficult to get a result as low as this, but the special circumstances of each individual case must be taken into account. The great point is that some competent person should be appointed by Government to test periodically the lightning conductors of all public or semi-public buildings, such as factories, workhouses, or schools, with authority to compel the proper authorities to make good any defects that may be discovered. The cases which have come under the writer's personal notice prove that the risk which the inmates of such buildings run is enormous, and it is undoubtedly increased by the fact that the buildings are supposed to be secure from danger. In most cases the fancied security could be made real at very small cost, and were such an inspector appointed, the saving both to life and property in a single year would repay a thousandfold all the expenses of the appointment. In this respect, as in many others, we should do well to take a lesson from our neighbours across the Channel. As Mr. Anderson very justly says:—"It is lamentable to think that although the periodic inspection of lightning-conductors has been admitted long ago to be a necessity in many countries on the Continent of Europe, we as yet have taken no steps whatever to realise it." May we hope that with a new Parliament some steps will be taken to alter this lamentable state of things?

* Of course there must be a large number of rods of this size.

Lectures at Exeter Hall.—We hear that the evening lectures at Exeter Hall, by Mr. Gribble, on "Science of construction," given in the Educational Section of the Young Men's Christian Association, have been so well received that the Committee have arranged with him for the delivery of two courses, advanced and elementary, on Mondays and Thursdays, from half-past seven to half-past nine, p.m. The subject for the opening lecture, on the 11th inst., is stated to be the Cannon-street Station Roof. Those who are desirous of attending such lectures should send to the secretary, Exeter Hall, London, for the syllabus.

TWO DOOMED LONDON CHURCHES: ST. THOMAS IN THE ROLLS AND HOLY TRINITY, MINORIES.

IT appears that the Bishop of London is proceeding, under the Union of Benefices Act, with a scheme of his predecessor in this See, for de-consecrating four more London churches. These are the churches of St. Olave, Jewry; St. Katharine Coleman, Fenchurch-street; St. Thomas in the Liberty of the Rolls; and Holy Trinity, Minories, in the Liberty of the Tower. To the former two edifices and their history we have already adverted in our columns.* The Rolls Chapel marks the site of the *Domus Conversorum* which Henry III., in 1233, gave up to the use of such Jews as embraced Christianity. But the rigorous enactments of his successor on the throne left few Jews for conversion, and to them the new faith was scarcely presented from its most attractive side. The house was accordingly given (1377) to Thomas Burstal, clerk, our first *Custos Rotulorum*. For nearly two hundred years the clergy supplied occupants for that honourable office; in 1534 Thomas Cromwell was appointed Master. This present generation has seen one of our greatest judges,—himself an unconverted Jew,—preside over the Rolls Court. The existing chapel was built in 1617-20, at a cost of 2,000*l.*, and, according to Pennant, edit. 1790, by Inigo Jones. The echoes of Dr. Donne's consecration sermon, of Burnet's, Atterbury's, and Butler's eloquence, have long died away. But within its flint walls, encumbered from time to time with record-chests, are preserved a valuable set of monuments. Chiefest of all is one in a style infrequent in this country, but familiar to us at Bologna and Florence, and ascribed by Walpole and Vertue to Torregiano. It commemorates Dr. John Young, Master of the Rolls *temp.* Henry VIII. There are others to Sir Edward Bruce, Master of the Rolls to James I. who advanced him Earl of Kinloss, and ancestor to the existing noble houses of Elgin and Ailesbury; to Sir Richard Allington, of Horseheath, co. Cambridge (1561), and to Sir John Trevor, Speaker, whereof the simple inscription, "Sir J. T., M.R., 1717," fails to recall how he had to put the question to the House that he himself be pronounced guilty of bribery and corrupt practices. A large west window contains good specimens of stained glass, comprising the arms of Sir Robert Cecil and Sir Harbottle Grimston. Most of the surrounding houses (since replaced) were built when Sir Joseph Jekyll on entering office took up his residence here. He contributed 3,500*l.* towards the expense for ten of them, saying he "would have them built as strong and as well as if they had been his own inheritance." Next, northwards of the Rolls, stood Symonds' Inn, wherein Richard Carstone, of "Bleak House," had chambers.

To destroy Holy Trinity Church, together with its more venerable neighbour the Sieve Tavern,† will finish the demolition in the Minories which has accompanied the construction of the railway from Aldgate to the Tower. As rebuilt in 1706, of brick, and at a cost of 700*l.*, the church can boast of but slender architectural attractions. Nevertheless, it stands a useful landmark, inasmuch as in its northern wall may yet be traced some vestiges of the Convent owned by the Poor Sisters of St. Clare. The Nuns Minoresses had been established here by Blanche, Queen of Navarre, second wife to Edmund, first Earl of Lancaster, and founder of that distinguished house.‡ To their charge Edward I. committed the heart of his mother, Eleanor of Provence (who died at Ambresbury 1291); and Dean Stanley reminds us how Edmund's tomb in

* See the *Builder* for December 16th, 1882; and October 20th, 1883.

† Northern side of Church-street. Already in part dismantled, this interesting structure is well-nigh as old as the more celebrated Fountain Inn which, standing hard by, was pulled down in 1795. A good view of the Fountain will be found in the Crowle Pennant; and a model thereof in "Old London," South Kensington: No. 19.

‡ Both Peter Cunningham and John Timbs, followed by many less careful inquirers, wrongly connect Holy Trinity, Minories, with the adjacent Priory of Holy Trinity without Aldgate.

suffice it to say, that a before-and-after wash-tank is usually the kind adopted. The before-wash moistens the sides of the bowl, and prevents the adhesion of fœcal matter. The after-wash carries everything through the trap into the sewer. The before-wash is produced when the seat is pressed down, and the after-wash is brought into play when the seat is relieved of pressure.

Traps.—Between water-closets and the soil-pipe, 4 in. or 3¼ in. S or V traps are invariably used in the United States. The trap is porcelain, and forms a part of the closet in a large number of cases. When made in connexion with the closet, it sets above the floor.

The traps placed beneath closets are like the illustration (fig. 5 C, p. 5 *ante*). Under sinks, bath tubs and wash-basins, and laundry tubs, 1¼ in. or 2 in. S or V are usually used (see fig. 10, F). Plumbing regulations require these traps to be ventilated. Grease-traps are rarely put under kitchen sinks, except in large public houses. A number of patent water-seal and mechanical traps are used to a greater or less extent under basins, baths, &c. I illustrate the kinds which have had or are having the most extended use.

The large English D and pot traps are never used in this country, as they are supposed to accumulate and retain waste matter instead of discharging it into the soil-pipe. Not many years ago it was common to placed leaden S traps under closets. As it was a common occurrence for servants, and possibly other careless people, if the traps became in any way clogged, or if they wished to get any uncommonly large object through the trap to punch holes in them with sticks.

For this and other reasons mentioned in connexion with leaden pipe, iron traps are invariably used under closets. Small traps for wash-basins, baths, &c., are usually made of lead.

The subject of trap ventilation has been a bone of contention for some years in this country. Sanitarians a few years ago were unanimous in their advocacy of trap ventilation. It was claimed that thus trap syphonage, or the destruction of the water seal, was prevented, whether caused by vacuum, or momentum of the water, or by back-pressure of gases. This was supposed to have been an undisputed fact, and municipal plumbing regulations have invariably inserted a clause requiring trap ventilation. Mr. Geo. E. Waring, jun., and Mr. J. Pickering Putnam claim that it is not only useless, but wrong to ventilate traps. Both these have monetary interest in appliances which do not require ventilation, the sale of which is injured by the aforesaid regulations. This creates a natural doubt in the minds of those interested, unfortunately, for fear that their opinions are unknowingly biassed by their pockets. E. S. Philbrick, Dr. John S. Billings, Henry C. Meyer (editor *Sanitary Engineer*), and others, assert that trap ventilation is the proper thing.

I am now carrying on an exhaustive series of experiments to determine these and other disputed questions in plumbing, under the auspices of the Museum of Hygiene, United States Navy Department.

The traps illustrated in fig. 10 are the different kinds usually used in connexion with wash-basins, bath tubs, and sinks.

The simple S and V are the kind most generally used, made of lead (fig. 10). As shown in the illustration, the vent-pipe is enlarged, so no deposit can take place in it.

The "Sanitas" trap is professedly anti-syphon. It consists of an S trap, with a glass compartment and separator let into the side. This trap holds quite a body of water, and the waste water has a tortuous passage in going through it (fig. 10, D and E).

The "Bower" is a mechanical valve, the ball being presumably able to resist any back pressure of gases. The ball floats. The bottom of the trap is glass, so any collection of sediment can be easily seen and removed.

The "Cudell" and "Bermor" traps both have a ball valve that takes its seat by gravity. The illustrations show their form and mechanism. They are easily taken apart, and the inside is always visible.

The tendency now is to use simple S traps, making them as small as the waste-pipe; in some cases smaller. The manufacturers are now making the outlets from wash-basins, bath tubs, &c., as large as the waste-pipe, so the pipes and traps will be efficiently scoured by the action of the water. This completes a running account of American methods of a house sewerage system. GLENN BROWN.

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electricity than iron, yet as the specific heat of the two metals is approximately the same, copper of equal conductivity is heated more than iron because of its smaller mass per foot run. M. Melsens' experiments have proved more than this, for he has shown that if a powerful current of electricity be passed through wires of copper and iron one-tenth of a millimètre in diameter, the iron will stand while the copper will be fused. For this reason it is not wise to use copper of less than three-eighths of an inch in diameter; but M. Melsens uses iron wire of about a quarter of an inch in diameter with perfect safety.* It used to be considered that prominence was the special element of danger to a building, but isolation is equally so, and the probability is that a small farm-house or barn standing by itself in a hollow, especially if the neighbourhood be damp, is specially liable to be struck. The cheapness of the Melsens system is its great recommendation, and the inventor has published details of cost which show that small buildings can be efficiently protected at a cost of about 2d. per square mètre of surface, while the elaborate system adopted at the New Palais de Justice in Brussels cost only 6½d. per square mètre.

Whatever system of protection be adopted, there are three points of absolute importance:—(1) That conductors should be continuous for their entire length; (2) that all prominent masses of metal in a building should be brought into connexion with the conductors; and (3) that the conductors should have ample communication with damp earth. The first condition of continuity is, perhaps, best fulfilled by using the solid copper tape which was invented some years ago, and which is made in lengths of from 200 ft. to 400 ft., according to its weight per foot. When joints are necessary, it is not sufficient that the two adjacent ends of the rod should merely touch,—which state of things has been responsible for many accidents,—but the ends should be placed in close contact for about 6 in., and, in the case of circular rods, if the contiguous ends are filed so that the surfaces in contact are square so much the better; they should then be bolted together and covered with a mass of pewter solder. The second condition of safety is to connect all prominent masses of metal used in the construction of a building with the conductor, and it would certainly be better that the connexion should be at two points. This condition was not laid down by Gay-Lussac, because iron was not largely used in buildings at his time, but if the metal in a building be not connected with the conductor it is extremely probable that even if a portion of the lightning discharge takes its proper course, part of it may leap across from the conductor to the metal and do considerable damage. The third condition of adequate earth contact is the most important of all, and has been the most neglected. It has been stated that in order to transmit to moist earth an electric current with no more resistance than it meets with in traversing an iron rod of one square centimètre sectional area, the earth contact ought to consist of an iron plate 492 yards square. Of course, these theoretically perfect conditions cannot be practically complied with, but it should always be borne in mind that the superficial area of the underground portion of the conductor should be made as large as possible, and that in dry localities some artificial means of keeping it damp should be resorted to. Several means of securing extensive contact with moist earth are described by Mr. Anderson. In towns the gas and water mains afford an excellent earth, and it is calculated that by this means the earth contact of the conductors fixed to the Hôtel de Ville at Brussels is no less than 330,000 square yards. In country districts where mains are not available the conductor should always be laid in a trench and packed round with broken coke or charcoal, and should terminate if possible in a pond or some running water. It should never be forgotten that an artificial stone tank or reservoir is not an earth at all.

Now, if the carrying out of certain well-known conditions will ensure the safety of a building from lightning strokes,—and, apart from scientific testimony, the fact that many manufacturers are willing to guarantee the security of buildings fitted by them with lightning rods, is fairly good evidence that this is the case,—what is the cause of so many accidents occurring to buildings even when they have been furnished with rods? Simply that no systematic arrangements exist in this country for periodically inspecting and testing lightning-rods. Mr. Anderson lays great stress upon the necessity for this regular inspection, and it is impossible to insist upon it too strongly. We do not believe that any conductor which has been fixed for five years, and not inspected and tested in the meantime, would be found perfect at the present moment. The conductivity of a lightning-rod may be impaired in many ways. A lightning stroke may have passed harmlessly and yet have caused damage to the pointed terminals. In the case of iron, rust may have corroded the points. Artisans at work on the roof may have carelessly cut off the connexion with the gutter and other ironwork; new metal-work may have been introduced in such a way as to offer a readier path for the electric current than the conductor itself; alterations in the drainage of the neighbourhood may have converted a good earth into a bad one,—these and a thousand other simple accidents may have completely altered the conditions which existed at the time when the rod was first fixed, and it may often happen that these alterations cannot be discovered by mere inspection, but only by a test conducted by an experienced investigator, with the help of a galvanometer. Both the continuity of the conductor and the earth resistance should be tested, and the accurate determination of the latter is sometimes a rather complicated piece of work. What is the maximum earth resistance compatible with safety is a moot point. Mr. Anderson says that in France a resistance of 25 ohms is considered safe; but a correspondent of the *Electrician* says that we ought never to be satisfied with a higher resistance than 2 ohms in dry weather, and in most cases it would not be difficult to get a result as low as this, but the special circumstances of each individual case must be taken into account. The great point is that some competent person should be appointed by Government to test periodically the lightning conductors of all public or semi-public buildings, such as factories, workhouses, or schools, with authority to compel the proper authorities to make good any defects that may be discovered. The cases which have come under the writer's personal notice prove that the risk which the inmates of such buildings run is enormous, and it is undoubtedly increased by the fact that the buildings are supposed to be secure from danger. In most cases the fancied security could be made real at very small cost, and were such an inspector appointed, the saving both to life and property in a single year would repay a thousandfold all the expenses of the appointment. In this respect, as in many others, we should do well to take a lesson from our neighbours across the Channel. As Mr. Anderson very justly says:—"It is lamentable to think that although the periodic inspection of lightning-conductors has been admitted long ago to be a necessity in many countries on the Continent of Europe, we as yet have taken no steps whatever to realise it." May we hope that with a new Parliament some steps will be taken to alter this lamentable state of things?

* Of course there must be a large number of rods of this size.

Lectures at Exeter Hall.—We hear that the evening lectures at Exeter Hall, by Mr. Gribble, on "Science of construction," given in the Educational Section of the Young Men's Christian Association, have been so well received that the Committee have arranged with him for the delivery of two courses, advanced and elementary, on Mondays and Thursdays, from half-past seven to half-past nine, p.m. The subject for the opening lecture, on the 11th inst., is stated to be the Cannon-street Station Roof. Those who are desirous of attending such lectures should send to the secretary, Exeter Hall, London, for the syllabus.

TWO DOOMED LONDON CHURCHES: ST. THOMAS IN THE ROLLS AND HOLY TRINITY, MINORIES.

IT appears that the Bishop of London is proceeding, under the Union of Benefices Act, with a scheme of his predecessor in this See, for de-consecrating four more London churches. These are the churches of St. Olave, Jewry; St. Katharine Coleman, Fenchurch-street; St. Thomas in the Liberty of the Rolls; and Holy Trinity, Minories, in the Liberty of the Tower. To the former two edifices and their history we have already adverted in our columns.* The Rolls Chapel marks the site of the *Domus Conversorum* which Henry III., in 1233, gave up to the use of such Jews as embraced Christianity. But the rigorous enactments of his successor on the throne left few Jews for conversion, and to them the new faith was scarcely presented from its most attractive side. The house was accordingly given (1377) to Thomas Burstal, clerk, our first *Custos Rotulorum*. For nearly two hundred years the clergy supplied occupants for that honourable office; in 1534 Thomas Cromwell was appointed Master. This present generation has seen one of our greatest judges, — himself an unconverted Jew,— preside over the Rolls Court. The existing chapel was built in 1617-20, at a cost of 2,000*l.*, and, according to Pennant, edit. 1790, by Inigo Jones. The echoes of Dr. Donne's consecration sermon, of Burnet's, Atterbury's, and Butler's eloquence, have long died away. But within its flint walls, encumbered from time to time with record-chests, are preserved a valuable set of monuments. Chiefest of all is one in a style infrequent in this country, but familiar to us at Bologna and Florence, and ascribed by Walpole and Vertue to Torregiano. It commemorates Dr. John Young, Master of the Rolls *temp.* Henry VIII. There are others to Sir Edward Bruce, Master of the Rolls to James I. who advanced him Earl of Kinloss, and ancestor to the existing noble houses of Elgin and Ailesbury; to Sir Richard Allington, of Horseheath, co. Cambridge (1561), and to Sir John Trevor, Speaker, whereof the simple inscription, "Sir J. T., M.R., 1717," fails to recall how he had to put the question to the House that he himself be pronounced guilty of bribery and corrupt practices. A large west window contains good specimens of stained glass, comprising the arms of Sir Robert Cecil and Sir Harbottle Grimston. Most of the surrounding houses (since replaced) were built when Sir Joseph Jekyll on entering office took up his residence here. He contributed 3,500*l.* towards the expense for ten of them, saying he "would have them built as strong and as well as if they had been his own inheritance." Next, northwards of the Rolls, stood Symonds' Inn, wherein Richard Carstone, of "Bleak House," had chambers.

To destroy Holy Trinity Church, together with its more venerable neighbour the Sieve Tavern,† will finish the demolition in the Minories which has accompanied the construction of the railway from Aldgate to the Tower. As rebuilt in 1706, of brick, and at a cost of 700*l.*, the church can boast of but slender architectural attractions. Nevertheless, it stands a useful landmark, inasmuch as in its northern wall may yet be traced some vestiges of the Convent owned by the Poor Sisters of St. Clare. The Nuns Minoresses had been established here by Blanche, Queen of Navarre, second wife to Edmund, first Earl of Lancaster, and founder of that distinguished house.‡ To their charge Edward I. committed the heart of his mother, Eleanor of Provence (who died at Ambresbury 1291); and Dean Stanley reminds us how Edmund's tomb in

* See the *Builder* for December 18th, 1882; and October 20th, 1883.

† Northern side of Church-street. Already in part dismantled, this interesting structure is well-nigh as old as the more celebrated Fountain Inn which, standing hard by, was pulled down in 1795. A good view of the Fountain will be found in the Crowle Pennant; and a model thereof in "Old London," South Kensington: No. 19.

‡ Both Peter Cunningham and John Timbs, followed by many less careful inquirers, wrongly connect Holy Trinity, Minories, with the adjacent Priory of Holy Trinity without Aldgate.

Westminster bears the roses,—misnamed "of Provence,"—which, carried thither by the Crusaders, he brought to England from Provence and adopted as the Lancastrian badge. In the convent churchyard were interred Henry Waleys, oftentimes Lord Mayor in the end of the thirteenth century, a benefactor to these as he was to the Franciscans at Grey Friars, Newgate; and Elizabeth, widow to Sir Henry Bourchier, who by her marriage with Thomas (Howard), first Duke of Norfolk, was mother to the Viscountess Rochford, Anne Boleyn's mother. Here, too, were buried some bones from Culloden field. The *Sorores Minores* borrowed their style, as also their rule and the colour of their habit, from the Franciscans, or *Fratres Minores*, whose founder was a fellow townsman of their own, St. Clara. Dame Elizabeth Salvage, last titular abbess, surrendered the convent to Henry VIII. in 1539. The site was afterwards occupied by a colony of gunsmiths and founders,—the deformed Mulcibers whom Congreve pictures as forging "those stays of steel, which arm Aurelia with a shape to kill."

After the Dissolution this property passed in turn to several persons of quality, including the Bishops of Bath and Wells (in lieu of their Strand "inn") and the Greys.* Henry Grey, Duke of Suffolk, held it by patent of Edward VI., 1552; but, within a few months, he conveyed it to his two brothers, Lords John and Thomas Grey, and one Mr. Medley. On the Duke's attainder and execution (1554) it reverted to the Crown until the Restoration, when a new residence was built on the ground, and called the King's, for what reason, says Pennant, is unknown. Meanwhile the convent precincts had been formed into a separate parish, with a church especially appropriated to the inhabitants of the Close. "The church," writes Strype, "pretends to privileges, as marrying without licence." This franchise was probably a survival of an exemption granted by Boniface VIII. as early as 1294. The font comes from the old church. Around the fountain was built Haydon-square, where until lately stood the homes of Newton and Hogarth. In the old church, too, was buried (1633) Cornelius Deibbel, who may justly claim to share with Fontana the honour of having invented the microscope. Extending over five acres the parish is extra-municipal, but lies within the Tower Liberties. It takes so much out of Portsoken Ward as is covered by the space bounded by Church-street, the Minories, and Haydon-street, together with the space occupied by Haydon-square, and the depot (with part of the branch line) of the London and North-Western Railway Company. A Roman burial-ground to the east was site of the Convent-farm whereat Stow in his youth would buy "many a halfpennyworth of milk. . . . always hot from the kine." One Goodman let out the land for pasture and then for garden plots. On Goodman's Fields were subsequently built Prescot, Ayliffe, Leman, and Maunsell streets, whilst the Clothworkers' tenter-grounds gave a name to Tenter-street. Charles II. granted the King's House to Colonel William Legge, who attending Charles I. to the scaffold, was there charged by the king that he should bid the Prince of Wales to remember the faithfullest servant that ever prince had. His fidelity was further rewarded with several lucrative and honourable offices. Colonel Legge lived here until his death in 1670.† Elevated to the peerage, December 2nd, 1682, his eldest son George was the celebrated naval and military commander in the service of kings Charles II. and James II. But falling, together with his party, at the Revolution, Lord Dartmouth was deprived of his high employments, and committed to the Tower. There he died on the 25th of October, 1691. His only son, William, was advanced Viscount Lewisham and Earl of Dartmouth, September 5th, 1711, and his descendants for a long while enjoyed a right of sepulture in the vault which was built beneath the floor of this church by their ancestor, Colonel William Legge. At Holy Trinity Sir Philip Sidney's remains were laid in state, and hither came the Grocers' Company on horseback to take the body to St. Paul's.

In the year 1839 a decapitated head was dug up from the southern or parish chancel vault. When first found this singular relic retained all its teeth, the eyes, and ample traces of a ruddy beard. For twenty years past the head, —originally tanned, it is believed, by deposit in oaken sawdust,—has been shown as that of Lady Jane Grey's father, the Duke of Suffolk, of whom we speak above. Moreover, some authorities would fain discern in its well-preserved features a likeness to those of that nobleman as prefigured by Lodge's portrait, engraved after the original at Hatfield, and of which a replica belongs to our National Portrait Gallery. Others have claimed it for the Duke of Monmouth. The Legges, we gather, are satisfied that this head, which clearly bears marks of having been clumsily severed, belongs to no member of their family. In a recent communication to *Notes and Queries* (Oct. 17, 1885, 6th, s. xii.) the Rev. E. M. Tomlinson, vicar, discusses this point. After showing that, if of date earlier than 1706, the head must have been interred in the earth, he states that he finds no clue as to its identity in the registers, which begin with the year 1566. He goes on to propound a theory, and upon what are apparently tenable premisses, that it is the head of Edmund de la Pole, Earl of Suffolk,* whom King Henry VIII. caused to be executed in 1513. There is evidence that this Earl of Suffolk, his wife, and his daughter were all buried in St. Clare Convent, and that the daughter had taken vows there. A tradition exists that the pious daughter, anticipating Margaret Roper, induced her sister nuns to join her in proceeding to the Tower, there to ask that the head of the duke (*sic*) of Suffolk might be delivered to her care. Duke her father never was; and at the date of Henry Grey Duke of Suffolk's execution, the Minoresses had ceased to be. Still it is by no means improbable that the decapitated head is a relic of the De la Poles who, descended from William, "king's merchant" to Edward III., are famed alike for their successes as for their misfortunes.

* John Clerke, who succeeded Wolsey in that see, was buried here 1540.

† *Vide* the registers. "Colonel William Legg of the Bedchamber, and Leftennant of his Maidsties Ordinance, was buried in the vault of the chancell, Oct. 20th, 1670." He died October 12th of that year; as see also Collins's Peerage, 1714; on his monument in the church the year is given as 1672.

NOTES.

THE snowstorm of Wednesday morning found the local authorities of the metropolis, as usual, for the most part quite unable, or unwilling, to cope with the difficulties which it interposed in the way of street locomotion. Making due allowance for the heaviness of the fall, and for the circumstance that it continued during all the busy hours of the morning, it is inexplicable to us why more vigorous efforts could not have been made on Wednesday afternoon to clear at least the main roads and streets of the metropolis of the slush which then covered them, and which was then easily removable. But, so far as our observation went, it was only in the City proper that anything was done in this direction. The frost of Wednesday night added to the miseries of pedestrians and horses in those localities where helpless inability or easy indifference had been the attitude of the "authorities." Take the case of Holborn as an instance. On the "Viaduct," and in all that part of Holborn within the City boundary, traffic on Thursday morning was conducted with tolerable safety and facility, because the City street authorities had done something on the previous day to clear the roadway. West of the City boundary, however, and especially between Gray's Inn-road and Chancery-lane, the snow had been left to itself up to one o'clock on Thursday, and the struggles of the long-suffering horses were painful to witness. The "masterly inactivity" of most of the metropolitan vestries and district boards on these occasions ought to give a fresh stimulus to the London Government question. Such scenes as were to be witnessed in some of the main thoroughfares of London on Wednesday night and Thursday morning are emphatically a disgrace to a civilised capital. The breaking of several of the overhead telegraph and telephone wires added to the discomforts and dangers of pedestrians.

* Nephew to Edward IV. and younger son to William, first Marquess and Duke of Suffolk, who was beheaded off Dover.

THE Schliemann Museum at Berlin is about to receive substantial additions. After protracted negotiations, the German Ambassador at Constantinople, Herr Radoivsky, has succeeded, on behalf of Dr. Schliemann, in buying back from the Turkish Government the pottery and other objects discovered in the excavations of 1878, 1879, and 1882, at Troy. Part of these, it will be remembered, fell by contract to the Turks. Dr. Schliemann intends to undertake the cost of such restorations as are necessary, and will then hand them over to the section of the Kunst-Gewerbe Museum, which has for some years borne his name. It is matter of universal congratulation that a collection of so great importance, and most unhappily sundered, should thus be brought together under one roof.

IT is proposed to hold a conference in some conveniently central room in London about the end of February to discuss the question of emigration, with the view of ascertaining what is the exact state of the labour market in the colonies; what workers are really required, and stand a chance of finding employment if they emigrate; what accommodation is provided for emigrants on the voyage and at the depôts; and what have been the actual results of sending young females to the colonies. A circular which has been sent to us with this announcement states also that the Committee desire all information on the subject from any who will give such information to the secretary. The circular, however, does not give the name or address of the secretary, which is rather unbusinesslike. The subject is of the greatest importance.

BY good fortune the site of the ancient Etruscan city of Vetulonia seems to have been placed beyond a doubt; it proves to be actually about five miles further north than geographers have hitherto placed it. Signor Falchi, in excavating at Colonna (in the province of Grosseto), has lighted on what he considers to be incontestably the burial-ground of the city. So far all the tombs which have been excavated give evidence of the custom of cremation. The objects found in the tombs point to a very remote antiquity. The majority of the vases are undecorated, but where any design occurs it is of the very early geometric class. A few objects of bronze have been discovered, arms, fibulæ, &c., but metal on the whole is scarce. A paper by the discoverer appears in the "Notizie degli Scavi," pp. 98–152 and a few sketches of the objects found.

WE print elsewhere the first half of Mr. Robins's paper on "The Temple of Solomon" (read before the Architectural Association on the 1st inst.). The paper was an exceedingly interesting one, and was remarkable as being very fully illustrated, all the plans of the many writers who have conjecturally "restored" the Temple being exhibited on the walls. The paper elicited a lively discussion, Professor Kerr leading off with a speech in which he stoutly maintained that Solomon's Temple was, and could only have been, a *wooden* structure. Inferentially he expressed something akin to contempt for the theories of the archæologists who had devised "restorations" of the Temple, most of which were in stone and more or less partaking of the character of Greek or Egyptian temples. Mr. Robins, in concluding his paper, expressed his general concurrence with Mr. Fergusson's views. Mr. Stannus, in the course of an interesting speech, referred to the ability with which Mr. Fergusson had treated the

question in his "Temples of the Jews," and expressed his great regret,—a regret which all our readers will share with us,—that that able writer, who has done so much to throw light on obscure points in the history of architecture, is dangerously ill.

IT seems that the town of Brunswick, not satisfied with the ousting of the ducal family who have reigned there for over seven hundred years, are seriously contemplating the destruction of their ancient castle,—one of the six or seven buildings in Germany in which may still be seen the general arrangements and some of the architectural details of the residence and fortress of one of the practically independent nobles of the twelfth century. The projected Vandalism is of especial interest to Englishmen, from the fact that Queen Victoria is a member of the Guelph family, whose ancestral home it is proposed to demolish to make way for a new street. The original foundation of the castle dates back to the dark ages before the twelfth century, and is attributed to Dankward, a descendant of Wittekind, after whom it was called Dankwarderode. In the twelfth century it passed by right of his wife to the Emperor Lothair, and through his daughter Gertrude, who married the Duke of Bavaria and Saxony, to the Guelph family. It was Gertrude's son, Henry the Lion, who, about the year 1166, erected what, notwithstanding all additions and alterations, may be regarded as the existing building, and placed the world-famed Brunswick lion upon his pedestal in the courtyard, facing the flight of steps which led to the great hall of the castle. For the next hundred years Dankwarderode was the centre of all that was great and splendid in the land, second only to the Burg of the Emperor himself, the scene of constant hospitality and of frequent festivities; but its history subsequently to the death of Albert the Great in 1279 is a sad one. Belonging by arrangement to all the scattered branches of the family alike, jealousy prevented its being long inhabited by any; it was unrepaired, for that which was every one's business was no one's, and so ruinous had the castle become by the sixteenth century that a fire which took place at that period seems to have hardly made matters much worse. It, however, aroused Duke Julius in 1569 to undertake a scheme for the restoration at least of the great hall, a scheme which, through the jealousy of the other branches of the family, and the opposition of the town, was only very partially carried out in his lifetime, and was subsequently abandoned. This was fortunate as far as the historical interest of the structure is concerned, for the preservation of the Romanesque remains did not enter into the scheme. In 1700, and again in 1763, restorations of a more or less history-destroying character were carried out. Then came the period of the Westphalian rule in Brunswick, during which the castle was fitted up as a barrack; in 1867 it was given up to Prussia as a building used for military purposes; and in 1873 became, on the same grounds, the property of the German Empire. Another fire in this year destroyed the southern part of the building, and the rest, including the great hall, was sold to the town in 1878 to be pulled down to make way for new streets. The scheme has been vigorously opposed by the artistic and archæological world in Germany, and especially in the neighbouring learned little town of Wolfenbüttel, and has not yet been carried out; but, as has happened more than once or twice in similar circumstances in England, the united opinion of all who are capable of forming one is in danger of being contemptuously set aside by those in authority in Brunswick.

SO far as we are aware no action has been taken by the City authorities and the other bodies concerned to stop the erection of the warehouses at the eastern end of St. Paul's Churchyard, to which we have referred on two or three recent occasions. If the whole of the site of the St. Paul's School building cannot be thrown into the roadway it would, at any rate, certainly be desirable to set back the building-line a few feet, for the roadway is so narrow here that there is no room for a footpath on the side next the Cathedral railings. We are informed, however, that an arrangement has been come to for a mutual modification of their respective designs, by Mr. Delissa Joseph, the architect of the six warehouses now being erected upon the larger portion of the site of the School, and Mr. Frederick Heming, the architect of the three warehouses building upon the remainder of the site, whereby, we are told, "the whole frontage of over 240 ft. will be harmoniously treated as one imposing façade."

AMONG the discoveries reported during the excavations at Pompeii for 1885, the first place is undoubtedly taken by a mosaic, with a design representing doves drinking at a fountain. The mosaic is closely analogous to the well-known slab in the Capitoline Museum which goes by the name of "Pliny's doves." On a white slab stands a bronze basin supported by three lion's claws; it is filled with water. Three doves are already drinking; they stand perched on the rim of the basin; a fourth has just alighted; its wings are still outstretched; two others are standing beneath on the white marble slab. In the Capitoline mosaic, it will be remembered, all four doves are perched on the bowl, one only is actually drinking. The find of mural paintings this year is of no special interest.

THE railway traffic receipts for the month ending on the 27th of December, 1885, do not afford a very cheerful outlook for the half-year's dividends. On four lines, viz., the Great Northern, the London, Chatham, and Dover, the London and South-Western, and the Metropolitan, the aggregate increase in the gross receipts for the half-year (with four days' income yet to be added) has been 46,500*l.* But against this has to be set an aggregate decrease, on the sixteen other main lines generally brought forward for comparison, of nearly 570,000*l.*; making a net deficit in income of 523,000*l.* on a gross income of a little over 31,000,000*l.* The main fallings off which go to make up this deficit are, on the Great Western Railway, 105,000*l.*; on the London and North-Western, 110,000*l.*; and on the North-Eastern, 128,000*l.* It remains to be seen how far this decline on income is balanced by economy in expenditure. Against this, however, has to be reckoned the demand for interest on additional capital brought to account in the half-year. Roughly speaking, while our railway income ought, in a normal state of affairs, to show an increase of about 3½ per cent. in each year over its predecessor, the outcome of the last half of 1885 shows a decline of about 1¾ per cent. on the income of the corresponding period in 1884.

THE *Berliner Philologischer Wochenschrift* reports an archæological discovery on the Acropolis at Athens, which seems almost too good to be true. It is said that a colossal brazen statue has been found representing a female figure draped with a girded chiton, and extending the right hand in the attitude of one taking a solemn oath. With the statue was found a plinth of terra-cotta, on which is carved in very deep relief the figure of a man in armour, wearing a helmet. Traces of colour are still observable on the surface. Above the head of the warrior is the word KALOS in very archaic characters. From the same paper we learn that the excavations carried on in Bœotia have been rewarded by interesting discoveries. Two colossal lions, of archaic style and excellent preservation, have been found; also an archaic xoanon of Apollo and some inscriptions from which it may be safely inferred that near to the temple of Apollo Ptoos, the site of which has already been discovered, there was also a shrine sacred to Athene. Of the temple of Apollo Ptoos considerable architectural remains, among which are some coloured fragments, have been found. It was this temple that was seen by Pausanias, it will be remembered, in his wandering round Akraiphnia.

TWO or three correspondents have addressed letters to us, for which we cannot find space, in regard to the letter by Mr. Maclaren in our last number [p. 64], about the advisability or possibility of changing the style and title of the "Royal Institute of British Architects," and shortening the array of letters indicating membership; but only one of the suggestions made is much to the point. This is, that the word "British" should be omitted. It is not used by the Institution of Civil Engineers, nor by the "Royal Institute" or "Royal Society" of Water-Colour artists, and it certainly appears superfluous. The letters "F.I.A." are suggested by one writer as preferable to "F.R.I.B.A.," but these are already appropriated, and stand for "Fellow of the Institute of Actuaries." "F.R.I.A.," leaving out the "British," is not unreasonably long, and sufficiently explanatory. We are distinctly in favour of the suggestion to omit "British." It is, no doubt, "greatly to our credit" that we are British architects, but there is no need to be always proclaiming it.

THE TWO LOAN EXHIBITIONS.

THERE can be no doubt that the chief interest in regard to the two principal loan exhibitions of paintings is this year centred at the Grosvenor Gallery. The constantly-increasing popularity of Sir John Millais, as the most representative English painter of the day, has been emphasised and brought to a head, so to speak, by this very large collection of his works, which is crowded with eager and mostly enthusiastic spectators. We have the same complaint to make about the hanging which we have made in regard to previous exhibitions of a single painter's works at the Grosvenor. The system of hanging, if system it can be called, is simply stupid. As in former cases, there is not the slightest attempt to arrange the works chronologically, or in regard to phases of style; they seem to be arranged according to the size and proportion of the frames. The scene from Keats's "Isabella," which is the most remarkable of the works of Millais's pre-Raffaellite period, and one which every one wishes to see, is placed at the extreme end of the small gallery, where, owing to the crowd and the cramped access, it is difficult to get to it at all. Looking at the paintings in regard to style and feeling, the jumble is more extraordinary and gratuitous than even if we regard the chronological derangement. An arrangement of the paintings chronologically, as we have remarked before in regard to similar collections, would have given the exhibition a far higher interest, and even an educational value for the public, who could (such of them as go to a picture exhibition for more than mere amusement) have thus traced the steps in the change and development of the painter's style. An arrangement according to style, subject, and "æsthetic" generally would have had a special interest of another kind. The present arrangement is, as we have said, merely dependent on the size and shape of the frames, an absurdity for which the only possible excuse is the way in which the wall is cut up into sections by pilasters. Let architects who have to build picture-galleries for large annual exhibitions, where a number of pictures of constantly varying shapes and size have to be provided for, bear this hint in mind. When the Grosvenor Gallery was first instituted it was understood that it was to be for small and select exhibitions, and in such cases, where the entire wall space was not wanted, the division of the wall into compartments was suitable enough. But when it comes to making a large collection of the works of "the Reynolds of the nineteenth century" (or of "the Millais of the eighteenth century"), then the architectural divisions of the wall are a great inconvenience, and interfere with the proper and sensible arrangement of the works. A gallery for constant successions of exhibitions of various characters should have its walls entirely unencumbered by permanent architectural decorations. As Dr. Johnson is made to say in "Rejected Addresses":—"That which is permanent cannot be removed, for if removed it soon ceases to be permanent." If the pilasters at the Grosvenor Gallery would cease to be permanent it would, perhaps, be better for the hanging.

The paintings here collected, forming the most representative exhibition of their author's

work which has yet been seen, are as remarkable for their variety of aim as for their variety of power; in the case of the paintings dating from thirty to thirty-five years back it would be difficult for any one seeing them for the first time to believe that they were by the same artist who painted the later works. To those who have followed the work of Millais year by year at successive exhibitions, of course, "The Huguenots," and the other works of that date, have always remained as an impression, surviving in the mind as a background to the long array of portraits which have made the later fame and success of the artist. It is curious and very interesting to meet them again face to face with the artist's recent works; curious to think of the dislike, derision, and anger with which they were regarded on their first appearance, of the intensity of which Mr. Stephens has opportunely reminded us by citations of some criticisms of that time, in his copious and interesting notes to the catalogue. To-day there is a kind of murmur going about, among the throng at the Grosvenor Gallery, of regret that the artist had abandoned his earlier aim and method for his later style, and enthusiasts look fondly at the works of the pre-Raffaellite epoch, and shake their heads with a sigh over the lapse of one who began as an ideal and imaginative artist. But this reaction is not much more balanced or reasonable than the attacks which were made on these works when they first appeared. We share the regret so far as this, that we could have earnestly wished that an artist who showed at that early age so much imagination and such intense interest in telling an ideal story, should not have given his matured powers more often to subjects of this higher class, and with the same earnestness and enthusiasm. But it is a mistake to characterise these early works as showing an intensity of expression and of artistic purpose superior to that of Sir John Millais's later works. There is as much intensity and concentrated purpose in the portraits of Mr. Gladstone and Mr. J. C. Hook as in any of the early works, and a much greater style. In pictures like "Lorenzo and Isabella" there is most strenuous determination to paint the whole thing as thoroughly as possible, but it is a mass of brilliant parts rather than a whole, so far as painting is concerned. As a realisation of character it is, however, a most remarkable work, even in relation to the present fame of its author. So also is that odd creation, "Ariel luring Ferdinand." No one after first making the acquaintance of this painting could go back to the scene in the "Tempest" without feeling that he had got a new and more vivid perception of Shakspeare's weird fancy. Ariel, floating backward before Ferdinand, seems to draw the prince after him, and the attitude of the latter, with his hands hollowed over each ear, as if to catch a whisper, is a stroke of true genius; it makes us feel how vague and mystical is the sound of Ariel's song. The shortcoming is in the prince himself, whose face is simply a realistic portrait, not an ideal of the character; one of the odd perversities of "the pre-Raffaellite brethren," who were realistic exactly where idealism was specially demanded. "The Huguenot" retains its old hold over the spectators, but we have always considered this work over-rated, in comparison with others from the same hand. It is a wonderful piece of painting, but it does not express the real situation. A tender lovers' difference of some kind it is, but not a matter of life and death; there is no such stress of feeling in either countenance. We should even say that its great popularity is partly owing to the fact that it touches only such a pitch of feeling as the average or popular mind can rise to without difficulty.

Among the portraits which form by far the larger portion of the collection, are some which are below the artist's real level; but these shortcomings we take to be, in a kind of inverted way, among the evidences that he has the same intellectual interest in his art as when he was an "earnest" P.R.B. Sir John Millais paints his best when his subject interests him. Looking round at his gallery of portraits, it seems as if we could say almost with certainty in which of the sitters the artist was interested, and whom among them he cared little about painting. Whenever the subject of the portrait is a remarkable man, one of strongly defined character and personality, the portrait is sure to be remarkable too. Where the artist has been at work on a commonplace subject, he paints carelessly. This we take to be the true explanation of the great contrast in execution between one painting and another in this remarkable collection. As to the artistic *morale* of painting a thing (or a person) when you do not care for it,—well, that is a very large subject, which we will pass over just now.

Among the portraits which Sir John evidently did care for are, besides the two splendid ones of Mr. Gladstone and Mr. Hook before mentioned (the latter of which would have stamped its author a great painter if he had done nothing else), "Mr. Bright" (99), the "Duchess of Westminster" (which for true grace of ladyhood even Reynolds could not have surpassed), "the Marquis of Salisbury" (82), "the Earl of Beaconsfield" (84), "the Earl of Shaftesbury" (72), and "Sir James Paget" (103). All these are masterpieces of character in portraiture, giving not merely the outer physique of the sitter, but forming a kind of pictorial comment on his life; the "Marquis of Salisbury" seems the embodiment of the higher Toryism, the "Earl of Shaftesbury" of evangelical religion.

Among the later works of the painter which treat more or less ideal subjects, the finest is the large painting of "The Knight Errant" (41), which impresses us more than when we saw it at the Academy; the light and the situation are better for it, for one thing. The nude figure and the man in armour are equally fine as illustrations of two problems in painting, and the expression of the knight's face gives a nobility of meaning to the whole which raises it quite above the ordinary category of "nude studies." Not far from this the eye is caught by one of the most remarkable little bits of painting in the collection, the head of the rabbit in "Orphans" (49). The child is exquisite, but the rabbit fairly divides our attention, by the power with which the character and expression of the animal, and the texture of the fur, are rendered, without the slightest niggling or over-finish. "The North-west Passage" (60) asserts its power as fully as ever, as a grand painting of a figure of vigorous and energetic age. "Stella" and "Vanessa" (16 and 24) are two of the artist's greatest successes in ideal character; the style is wonderfully broad and powerful, and the figures very true to the ideal of Swift's two unhappy friends. Among the landscapes the first of all, "Chill October" (21), which came as a revelation to the artist's admirers, remains still the most poetic work of this kind which he has produced; but, on comparing it with "Over the Hills and Far Away" (17) we find the latter, which was regarded with some disappointment on its first exhibition, the more powerful work of the two; the foreground is a wonderful piece of realistic truthfulness, though there is less feeling in the painting than in "Chill October." Among other works which surprise us into an admiration which we had not felt on their first exhibition, is the large group of portraits of three Misses Armstrong, as they were then (two of the ladies, fortunately for two men at any rate, have changed their name since then), who were exhibited at the top of the large room at the Academy in 1872, under the title "Hearts are Trumps" (83). The over-large mass of crushed crinoline which occupies the lower part of the canvas is unfortunate in effect, and created a prejudice against the picture when it appeared; but then that was partly the ladies' fault for wearing crinoline; the full broad painting of the three fine young heads, the grace, the dignity, the admirably-contrasted character and manner in each of them, combine to make this a great picture, if only the lower portion of the canvas could be cut off.

We might expend much more time very pleasantly in going over other characteristics of this collection, so remarkable as the work of one man, but have not space to say all we could wish to say. We may quit the exhibition with the remark that Sir John Millais, at least, does not suffer under that severe test, the collection of a great number of his works in one gallery, and that most of those who study his paintings in this "collected edition" will have a higher estimate of his powers than ever, in spite of some hastily-painted and not very fortunate works among the later portraits.

The exhibition at Burlington House has been voted a failure in some quarters, but we do not see how this can be said of any exhibition which contains some superb Reynolds's and a whole room full of Turner's water-colours, and one of the finest Constable's in existence ("Stratford Mill," 158). Of course, one cannot expect the wealth of old masters in England to be absolutely inexhaustible, but Sir Joshua Reynolds seems almost to be so. Every year there come out some works of his not seen before at these exhibitions, and which seem as fine as anything he ever painted. The two leading examples this year are "Miss Fleming" (154) and "Lady Worsley" (157), both the property of the Earl of Harewood. The first is a full-length figure in profile, standing in, or, rather, walking slowly through, a landscape, with that natural ease of manner with which Reynolds animated his portraits. The small delicate head is beautifully painted. The other represents a very dashing young lady, in a kind of regimental uniform, with a riding-whip in her hand, and a black hat and feathers. Another beautiful work by Reynolds is the portrait (head and bust only) of "Mrs. Abington as Roxolana" (33), in the act of raising a curtain to come on the stage. In the same room is one of the numerous portraits of "Nelly O'Brien" (19), and one of the most charming in expression and pose of the head; Nelly might have been a saint, if beauty and sweetness of expression could have made her so. The picture is the property of Mrs. Cooper. In this first room is a small collection of the works of "Wright of Derby," which serves to show that he attempted other things than the clever effects of artificial light by which he is best known; it shows also that these were the things he could do best. His portrait of his sister (14) is, however, a fine work. Stothard's gay but hard little painting, "Sans Souci" (22), in the same room, is, we are sorry to say, covered with a whole network of cracks, and does not seem long for this world. A landscape by Reynolds, by the way (42), is a sufficiently unusual incident to be mentioned; it is a pleasant little painting.

Among the Dutch paintings in the second room the best are Jan Steen's "Afternoon" (86) and Ostade's "Interior of a Public-house" (97); there is a larger Jan Steen (90), an interior occupied by various more or less dissolute figures, but not painted with his highest finish or brilliancy; a good Snyders (81), for those who care for Snyders, of whom we are not, and an exquisite moonlight scene by Van der Neer (88).

The large room contains what purports to be one of the original repetitions by Titian of his well-known "Venus and Adonis" subject (109); it looks like an original. One of the most striking works in the large gallery is a picture which at once proclaims itself as Velasquez, "The Water-seller" (119), a picture in the painter's inimitable and powerful style, of a man in a brown robe giving water to a boy. This is a thoroughly good Velasquez, though not of so much interest in subject as some of his. Among other works not previously mentioned in the large gallery, are Reynolds's effective but stagey portrait of "Mrs. Hall as Euphrosyne" (147); Gainsborough's "Lady Brisco" (150), not a very good Gainsborough; Constable's "The Hay-wain" (153); and Turner's "The Pilot Boat" (156), one of the early and brown Turners.

Among the early Italian paintings in the fourth Gallery, the two gems are two works by Botticelli, "The Virgin and Child" (191), and a remarkably beautiful profile head, "La Bella Simonetta" (196). There are other works of artistic and historic interest in this part of the collection, including a fine portrait of Henry VIII., by Holbein (184), and we may return to this portion of the exhibition, but must close our memoranda for the present.

The Bombay Screen.—We learn from Bombay that the carved screen which is intended to be placed round the Bombay exhibits at the Colonial Exhibition in London this year is rapidly approaching completion. The work has been executed at the establishment of Mr. Winibridge, at Gowalia Tank. The total cost of the screen is estimated at 16,000 rupees, which is considered a very moderate sum for a work on such an elaborate scale. The material employed is unpolished Rangoon teak. The carved portion is an imitation of the ancient models found at Surat and Ahmedabad, the stone carvings of the latter mosques being reproduced in wood. The designer of the screen is Mr. J. Griffiths.

THE RIGHT TO AN EXTRAORDINARY AMOUNT OF LIGHT.

IT is to be regretted that the law upon the above subjection is not in a settled state, because it is a matter of much importance to many who have valuable businesses in our great towns to know what their rights are if the light to their premises is diminished. In ordinary cases, it is well known there must be a substantial diminution of light in order to give the owner of the dominant tenement a right to legal relief. But where light is used to an extraordinary extent for the purpose of a particular business, it is obvious that a less amount of obstruction may put an end to the business altogether. Is then the owner of the servient tenement in such a case as this to be in a worse plight than if he had obstructed the light to a dwelling-house or to a building which only required a normal amount of light? It is unfortunate that as full and satisfactory a reply to the question cannot be given as is desirable. The law may, however, to a certain extent be definitely laid down, and it is as follows, putting it into the form of a legal proposition. The owner of a dominant tenement has a right to an extraordinary degree of light necessary for a particular purpose when such an amount has been openly and uninterruptedly enjoyed for twenty years. So far as the first part of that proposition goes the law is plain and is supported by several judicial decisions, but these to a certain extent qualify it. In Lanfranchi *v.* Mackenzie, decided some years ago by the late Vice-Chancellor Malins, the judge laid it down that such a right as above expressed was good against all persons who had reasonable knowledge of such uses. This, it is obvious, very considerably diminishes the extent of the above proposition and only allows the right to prevail against a limited class of persons. But the general principle on which a right to light is gained in ordinary cases is by a twenty years' enjoyment, irrespective of any knowledge on the part of the owner of the servient tenement or any one else. The mere open and uninterrupted enjoyment creates the right and therefore it is a little difficult to see why there should be a distinction between the use of light for ordinary and for extraordinary purposes as regards creating a statutory right to it. Hence we are inclined to think that the right is valid whether persons know of it or not, so long as the enjoyment is open and uninterrupted. But the late Vice-Chancellor Stuart gave relief in the case of an obstruction of light used for an extraordinary purpose after eight years' enjoyment, and the same has been done in Ireland in the case of a seed merchant who had used a room for sampling seeds for seventeen years. But it is here again difficult to see why a person who has a special use for a room with a strong light should be in a better position than a person who only uses one for ordinary purposes. In both these cases to which we have referred, there was, no doubt, a right to a substantial amount of light, but that again seems to be no sound reason why a right to a still greater amount of light should be engrafted on the other right in a shorter period than is required for obtaining a statutory right under ordinary circumstances. If this legal doctrine is sound, the result is that if A. builds opposite a counting-house or a bank in the City, and slightly darkens the rooms, he has done no legal and actionable wrong. But if he happens to have opposite to him a diamond merchant or a silk merchant, who requires a strong light for sampling there, his building may be stopped, because though he has thereby only slightly diminished the light of the dominant tenement, yet he has obstructed it sufficiently to interrupt the particular business which requires an unusual amount of light. Therefore, the view of Vice-Chancellor Malins that twenty years' user of an extraordinary amount of light is required seems the soundest in law and most consonant with general convenience. We have a strong doubt, indeed, whether it is altogether advisable that there should be any right to an extraordinary amount of light obtainable. It causes one class of owners or occupiers of dominant tenements to be favoured above others to the disadvantage of the general body of building owners. Moreover, the balance of convenience seems to be in favour of allowing a person to build if he only slightly disturbs a man's light, and for the person who requires an extraordinary amount of light to move elsewhere. The conflicting interests of the owners of the dominant and servient tenements are always difficult and often impossible to reconcile. In the case of granting interlocutory injunctions to prevent the continuance of buildings which obstruct the light of another building, the Court always regards "the balance of convenience," and if we apply the same test to this point now under discussion, it will compel most persons to say that there should be no right to an extraordinary amount of light. Meanwhile, however, the law says that such a right can be gained, but judicial decisions differ as to the manner in which it can be acquired, and until some authoritative decision of the Court of Appeal the question will remain a doubtful one.

ANTIQUITIES OF MALVERN.

THE little affectation in the title of this book* may well be forgiven for the sake of its really valuable contents and for the tasteful manner in which, to the credit of local industry, they are offered to the public. Every one knows more or less of Malvern and of its Priory Church, which stand in picturesque prominence upon the slope of the Worcestershire beacon. But Mr. Nott, who has lived for thirty-five years beneath the shadow of the Priory and has already published some valuable notes upon its ancient stained glass, has a good deal to tell which has not hitherto been told, and, while professing no literary skill nor archæological learning, he has displayed quite sufficient of both to make his modest little history both interesting and valuable.

The historic memories of Malvern centre in its Priory which owed its foundation to the sagacity of Wulfstan, the last Saxon Bishop of Worcester. Instead of encouraging his neighbour Aldwin, a hermit of Malvern chase, to follow the fashionable pietism of the day and spend himself and his substance on a pilgrimage to Palestine, he bade him serve God at home and not seek Him at Jerusalem. The fruit of his advice was the establishment of Malvern Priory (taking the place of a smaller monastery) at the end of the eleventh or very beginning of the twelfth century. It was, therefore, almost coeval with Wulfstan's cathedral at Worcester, which Aldwin must have seen rising in the plain below.

It is scarcely necessary to say that the Norman building is not now to be seen in its entirety, but the church, which, with the gateway and refectory is all that remains of the Priory, possesses a good many of its original features. Of these the most important are the massive arches and pillars of the nave. "Plain though they are, there appears to have been at some period an intention to ornament them, as will be seen from the respond of the north-east pillar adjoining the tower. There a beginning at ornamentation was made, and on the third arch westward traces of zig-zag ornament are faintly marked out." Why these designs were not carried out we are unable to say, nor have we any means of ascertaining whether in the chancel and the other parts of the old church which have been reconstructed the same absence of detail prevailed. Undoubtedly the church underwent many alterations in the Transition and Decorated periods, but the great change in its character was effected in the fifteenth century, when the passion for Perpendicular work was at its height. Mr. Nott considers that the cause for the practical reconstruction of the church at that date is to be found not in the influence of a prevalent fashion, like that of "restoration" in these days, but in some unrecorded disaster in which the centre tower fell, and by its fall destroyed or irretrievably damaged the eastern portion of the church. He quotes Professor Willis's remark that it is some "proof that a tower is not Norman if it has not fallen," and that "this falling was a way they had got into and they could not help it." Of course, it is abundantly true that a good many Norman towers have fallen, and that a good many more, *e.g.*, Canterbury and Wells, would have fallen but for timely intervention; but these admissions come a long way short of evidence that the Perpendicular architects at Malvern merely availed themselves of an unsought opportunity. Be that as it may, they certainly made good use of it. The tower was carried up to its present lofty height, the parvice added, the great east window inserted in the new-built choir, the transepts widened, the aisles of the choir vaulted, and the walls of the chancel panelled throughout. In fact, the Priory Church received from the hands of Sir Reginald Bray very much the same impress as was left by the same architect upon his better-known works,—St. George's Chapel, Windsor, and Henry VII.'s Chapel, Westminster Abbey.

With the dissolution of monasteries the glories of Malvern Priory departed, and at the close of the eighteenth century the church was in a deplorable condition. In 1788 it was described as being in "too ruinous a state to be used with safety," and an anonymous contributor to the *Gentleman's Magazine*, after depicting, in bitter terms, the worse than neglect which prevailed, went on to describe the havoc committed by the children, "whose recreation consisted in throwing stones at the numerous windows, all full of the finest stained glass." Not much was done to remedy matters during the next forty years, and A. W. Pugin reports, in characteristic language, what he saw when visiting Malvern in 1833. "A few years ago a meeting of the fashionables in Malvern was called to subscribe towards the repairs of the dilapidated building, and by the help of raffles, &c., a few pounds were collected. Two hodfuls of mortar were got to repair the church, and the remainder of the money expended in putting in a window of the aisle the arms of the subscribers in stained glass, with their names in full,—a monument of their folly and arrogance. The very mullions in which the glass is placed, are rotten and falling. The church itself is in dreadful repair; fall it must, and all that is to be hoped is that in its fall it may annihilate those whose duty it was to have restored it; but of this we may be sure, that if it falls while there is a congregation within its walls, it will clear some away that ought to be got rid of, for such a set of lounging idlers as the fashionables of Malvern are only to be matched at Brighton or Cheltenham." Here Pugin rather unfairly ignores the honest efforts which the then vicar, Dr. Card, was making to retrieve past neglect. What he did was done substantially, though neither tastefully nor correctly, and he really set the example which succeeding vicars, living in happier times and aided by larger knowledge, have followed. The marvel is that, in spite of ignorant destruction and ignorant restoration, so much that is beautiful has survived, and that Malvern Priory Church can still show a wealth of stained glass and ancient paving tiles scarcely to be surpassed elsewhere, and no lack of those varied architectural features which make our ancient churches a constant source of interest and pleasure.

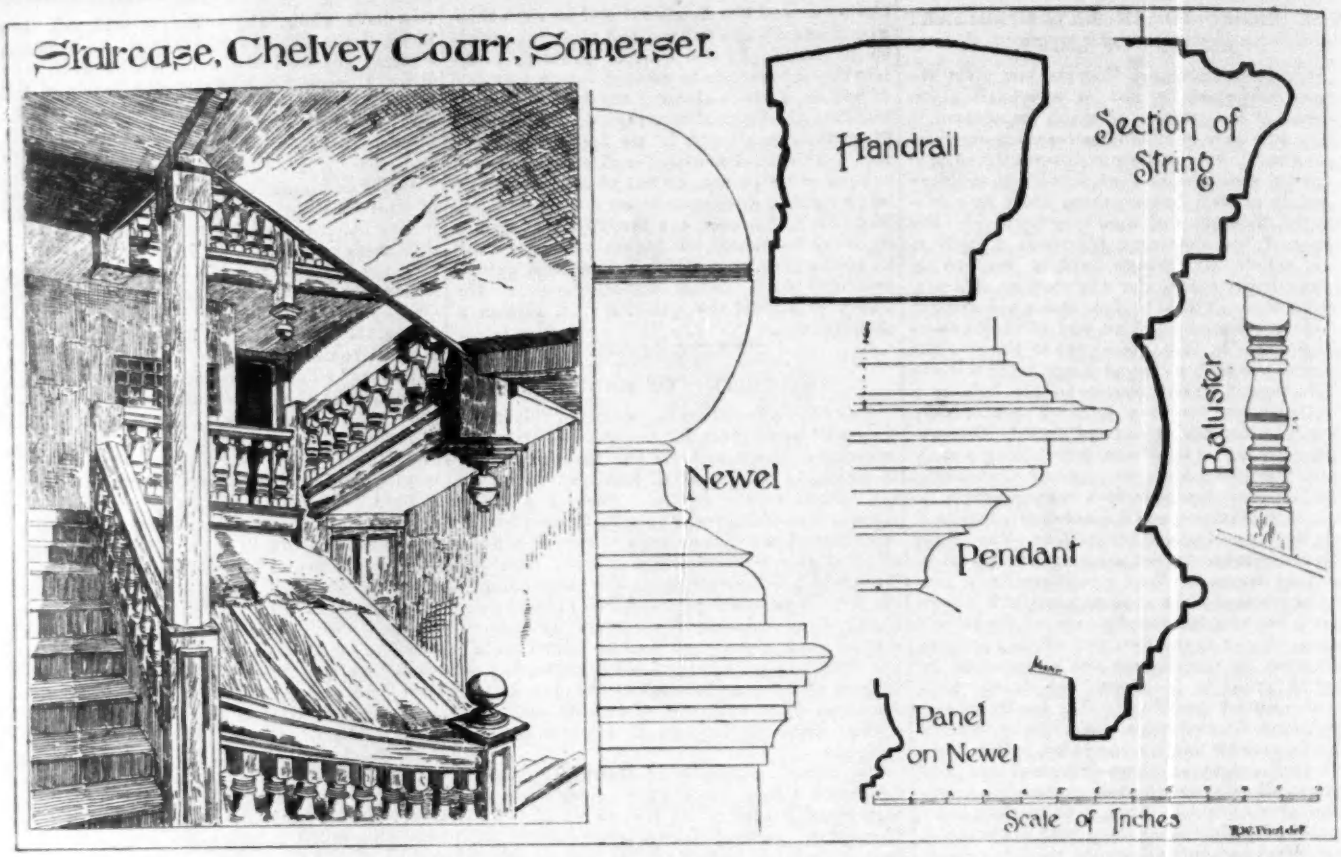
* Some of the Antiquities of "Moche Malverne" (Great Malvern). By James Nott. Malvern: J. Thompson.

COMPETITIONS.

Basingstoke School.—The School Board have recently invited six architects to submit designs for the new schools to accommodate 1,400 children. On receipt of the plans, it was decided to ask Mr. Roper, of John-street, Adelphi, to advise the Board upon them. This he has done, and recommended the adoption of the design marked "1885," as showing the greatest knowledge of school planning and most suited to the purpose. The author is Mr. Charles Bell, F.R.I.B.A., of London, and the Board have accordingly instructed Mr. Bell to prepare the requisite contract drawings forthwith. The estimated cost is 9,000*l.*

The Birmingham General Dispensary.—The plans for the proposed new branch building in connexion with the Birmingham General Dispensary have been selected by the committee appointed for that purpose. Messrs. Dempster & Heaton, of Corporation-street, in a limited competition, have been appointed the architects of the new building, which will be at the corner of Stratford-place and Moseley-road, near the old branch, which is at the Stratford-road, corner of Stratford-place. The new premises, which were urgently needed to meet the increased number of patients, will be erected on a site, the area of which is 765 square yards, with a frontage of over 100 ft. to the Moseley-road. The design of the building will be in the Jacobean style, freely treated. The front of the building will be of pressed red brick, with Kenilworth stone dressings, whilst the tower will be almost entirely built of Kenilworth stone. The roofs will be covered with plain red tiles.

"Sir Frederick Leighton, Bart."—We are very pleased to notice the new honour which has been bestowed upon the President of the Royal Academy of Arts.



Illustrations.

DESIGNS FOR THE LIVERPOOL CATHEDRAL.

FOR remarks on the three designs for this proposed cathedral, published among our illustrations for this week, see the first article in this number.

NEW ENGLISH CHURCH, BERLIN.

THIS building, which was consecrated by Bishop Titcomb on November 21st, the birthday of her Imperial Highness the Crown Princess, is situated in the gardens of the Monbijou Schloss at Berlin. While many other German cities have long had churches where large English congregations worship, the colony in Berlin has hitherto had to be content with a room in this same Schloss, which was originally intended for the ante-room to the theatre. It was mainly through the exertions of the Crown Princess during her last visit to England that funds were collected for the erection of the present church, and, by her influence, the site was presented by the Emperor. Her Royal Highness has also shown the keenest interest in the work, and, during the progress of the building, has been in frequent communication with the architect, Professor Raschdorff, of the Berlin Architectural School, best known here by his work on German Renaissance.

The church is built of rock-faced granite rubble work, with dressings of sandstone from Schleswig; and the roofs are covered with parti-coloured slating, except those of the bell-turret and porches, which are shingled. Inside, both the walls and roof, which is open-timbered, are covered with colour decoration in black, red, white, and gold; the gangways are paved with tiles presented by Messrs. Minton, who also gave those for the dado which surrounds the chancel. The seating and furniture is of oak. The organ, by Herr Sauer, of Frankfort-on-the-Oder, is placed in the chamber on the north side of the chancel, while the vestry and royal pew are on the south of the church.

The total cost has been about 300,000 marks, or 6,500*l.*; and sittings are provided for 300 worshippers.

It is to be regretted, from the point of view of almost every interest concerned, that a German architect should have been employed to erect an English church,—the distant situation of which only made it the more desirable that it should be peculiarly English, and the more difficult to make it so. But Herr Raschdorff may fairly be congratulated on having succeeded quite as well as could have been expected in a most difficult task, that of erecting a monumental building to satisfy tastes and requirements, presumably quite strange to him, in a style probably foreign alike to his own tastes and previous studies.

"RESTORATIONS OF SOLOMON'S TEMPLE."

THE two pages of plans, sections, &c., are given in illustration of Mr. E. C. Robins's paper, of which we print the first half this week (see p. 103).

THE CHARTERHOUSE.

THE Bill to authorise the sale or lease of the Middlesex estate of the Governors of Sutton's Hospital in Charterhouse has been printed. The preamble recites the Charter of the ninth year of the reign of King James I., granting full power, licence, and lawful authority to establish at or in a house called the late dissolved Charterhouse, besides Smithfield, and other premises, one hospital house, or place of biding, for the sustentation and relief of poor, aged, maimed, needy, or impotent people, and also one free school for the instructing, teaching, maintenance, and education of poor children or scholars. The foundation of the hospital and school was established and confirmed by an Act of Parliament of the third year of King Charles I. By another Act of Parliament, of the thirty-third of King George II., powers were given to the Governors to grant building leases of certain portions of their lands and estates, but this Act did not include the lands used in connexion with the hospital and school. The Charterhouse School Act of 1867 empowered the Governors to sell the school and the several residences in connexion therewith, and to acquire a new site for the school. This arrangement, as is well known, has been carried out, and the school removed to Godalming. An application has been made to the Charity Commissioners for a scheme for the more beneficial disposition of the endowments and revenues of the hospital, and to that end for the removal of the hospital and the establishment of a system of out-pensions in lieu thereof.

These objects, it is recited, cannot be effected without the authority of Parliament, and it is therefore proposed to take powers to enable the Governors to dispose of their land, or any part thereof, or to grant building or other leases for terms not exceeding ninety-nine years, provided that no such sale or exchange shall be made without the consent of the Chancery Division of the Supreme Court or of the Charity Commissioners. The Governors may further pull down and remove the buildings on the site of the hospital, and may form streets or roads or open spaces subject to the same consent as before. The burial-ground of the Charterhouse is proposed to be laid out as an open space, and power is given to hand it over to the Corporation of the City of London or the Metropolitan Board of Works. This burial-ground, which was the cemetery of the monastery, was closed by Order in Council in 1854, together with a number of other metropolitan graveyards.

THE ROYAL ACADEMY.

ADMISSIONS TO THE ARCHITECTURAL SCHOOL.

Upper School.

Allen, N. W.	Jones, W. C.
Gibbon, W. J.	Jemmett, A. R.
Goodrham, H. R.	Russell, S.
Hart, F. C.	Sedding, E. H.
Herbert, E.	Steinthal, A.

Lower School.

Barnsley, S. H.	Pierce, R. L.
Butter, W. R.	Piper, S.
Cooper, C. J. H.	Ryde, F. C.
Cooper, W. F.	Shortridge, A. D.
Cox, A. A.	Vickers, A. E.
Hart, A. H.	Wilson, A. N.
Haywood, C. S.	Worthington, T. L.
Morris, J. A.	

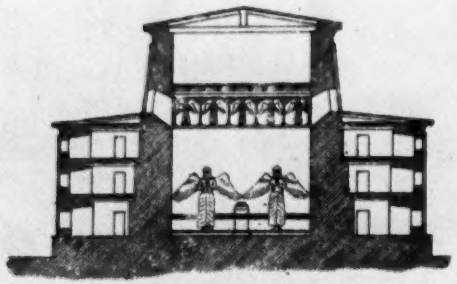
Probationers.

Butter, A. M.	Nicolay, G. W.
Daniels, H. S.	Paul, R. W.
Duke, W. M.	Spooner, C. S.
Frere, E. C.	Stoddart, A. E.
Haarer, F. E.	Taylor, N.
Homan, S.	Wilson, W. R.
Hopson, C. H.	Woollacott, H. E.
Murray, J.	Youngs, L.

Clock.—The Episcopal Church of St. Margaret, Forgue, diocese of Aberdeen, has been presented, at the sole cost of Mr. J. Morison, of the British College of Health, with a clock of superior design, specially constructed by Mr. J. W. Benson. The new clock has two copper dials of 4 ft. diameter, strikes the hours on a bell of 11 cwt., and is fitted with Graham's dead-beat escapement and all recent improvements. The additions to the tower necessary for the reception of the clock were planned by Mr. J. Duncan, Turriff.

Temple of Solomon:

Commendatore Caninas Design:

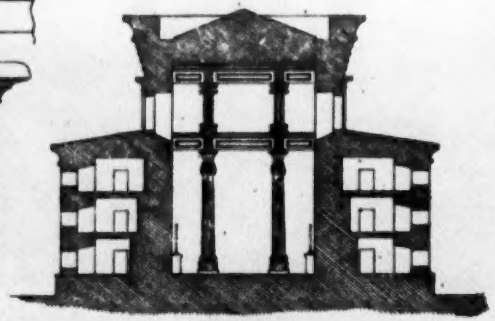


Section:

Elevation.

Scale [illegible] of Cubits.

E.C. Robins' F.S.A. Design:



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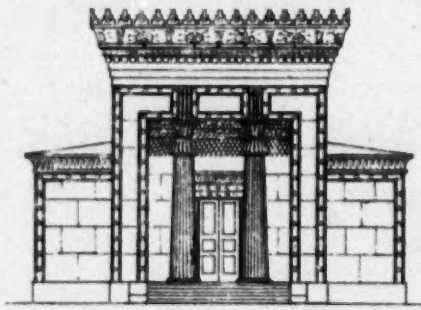
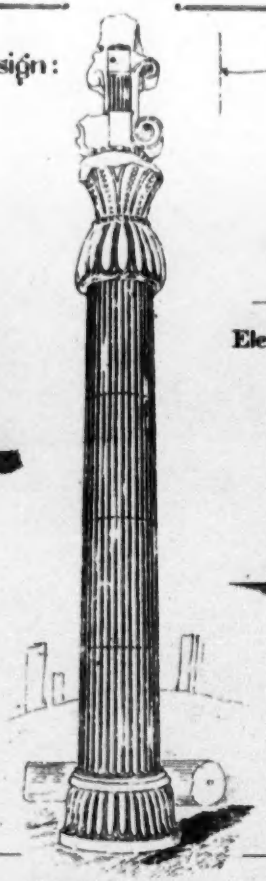


Elevation:

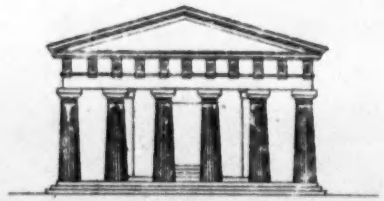
Scale [illegible] of Cubits.

Bronze Column:

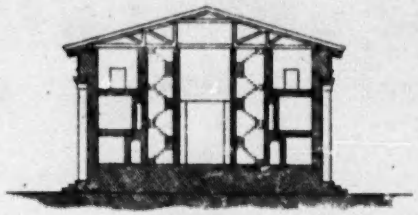
Sketch of Column at Persepolis:



Prof: Wilkins' Design:



Elevation of the Temple at Poestum:



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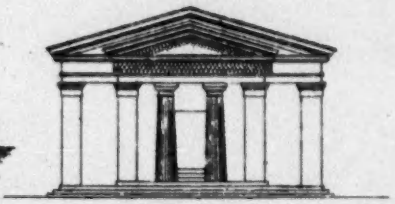
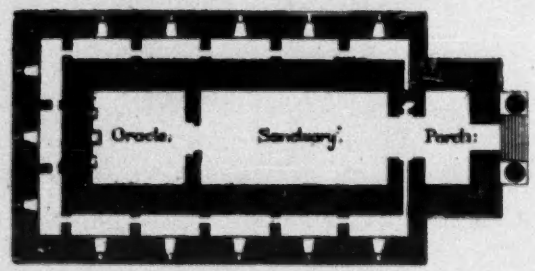
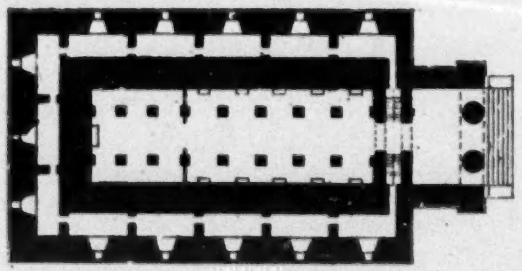


Elevation:



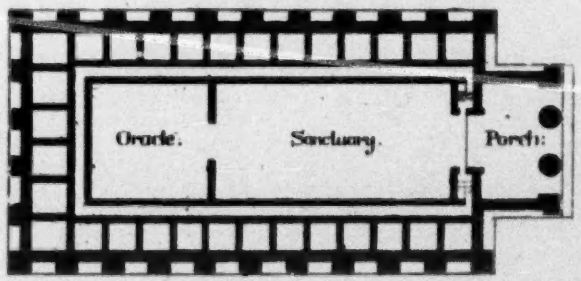
Ground Plan:

Scale [illegible] of Cubits.



Ground Plan:

Scale [illegible] of Cubits.



Ground Plan:

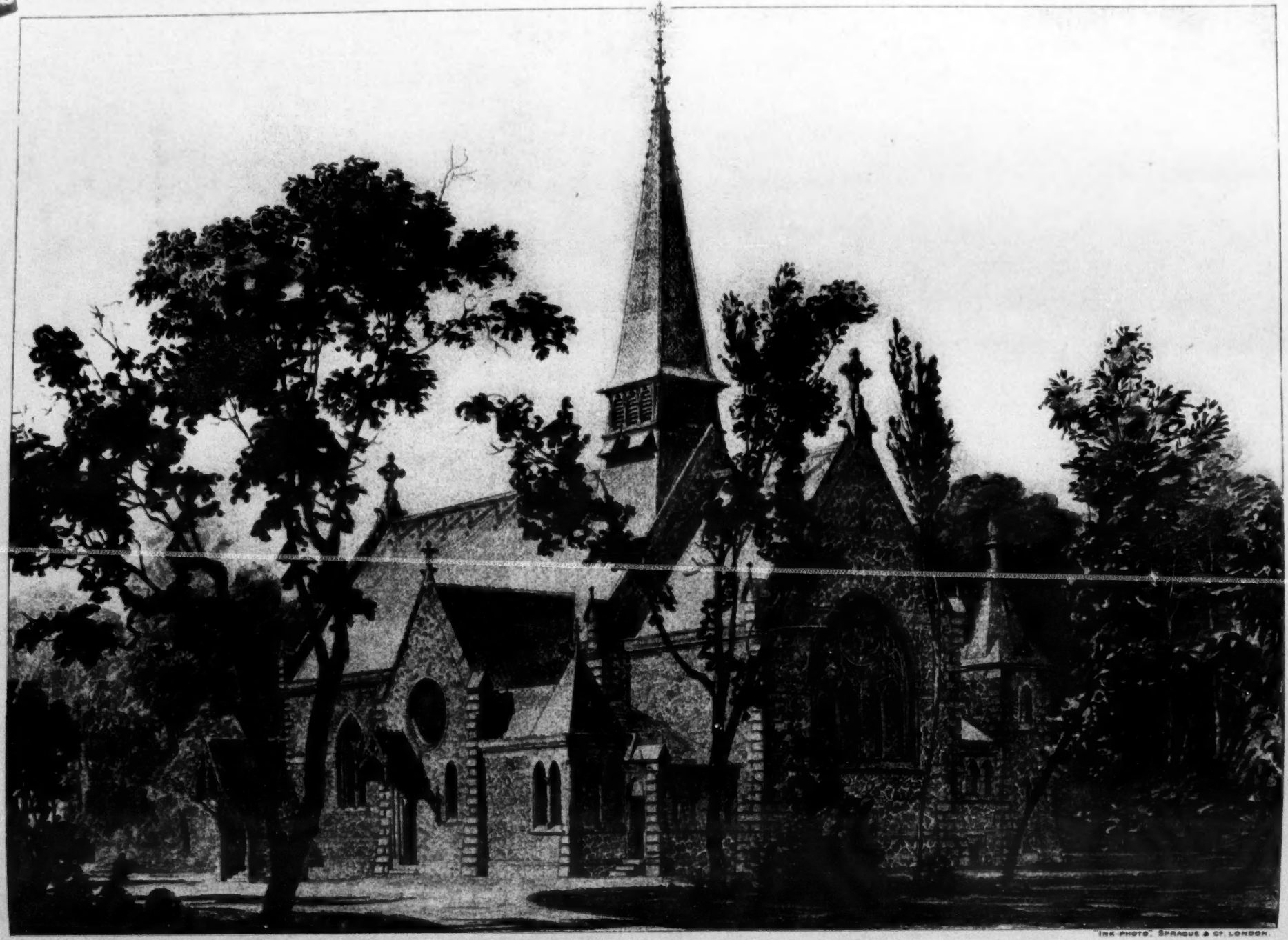
Scale [illegible] of Cubits.

Wyman & Sons, Photo-Litho.

C. Queen St. London, W.C.

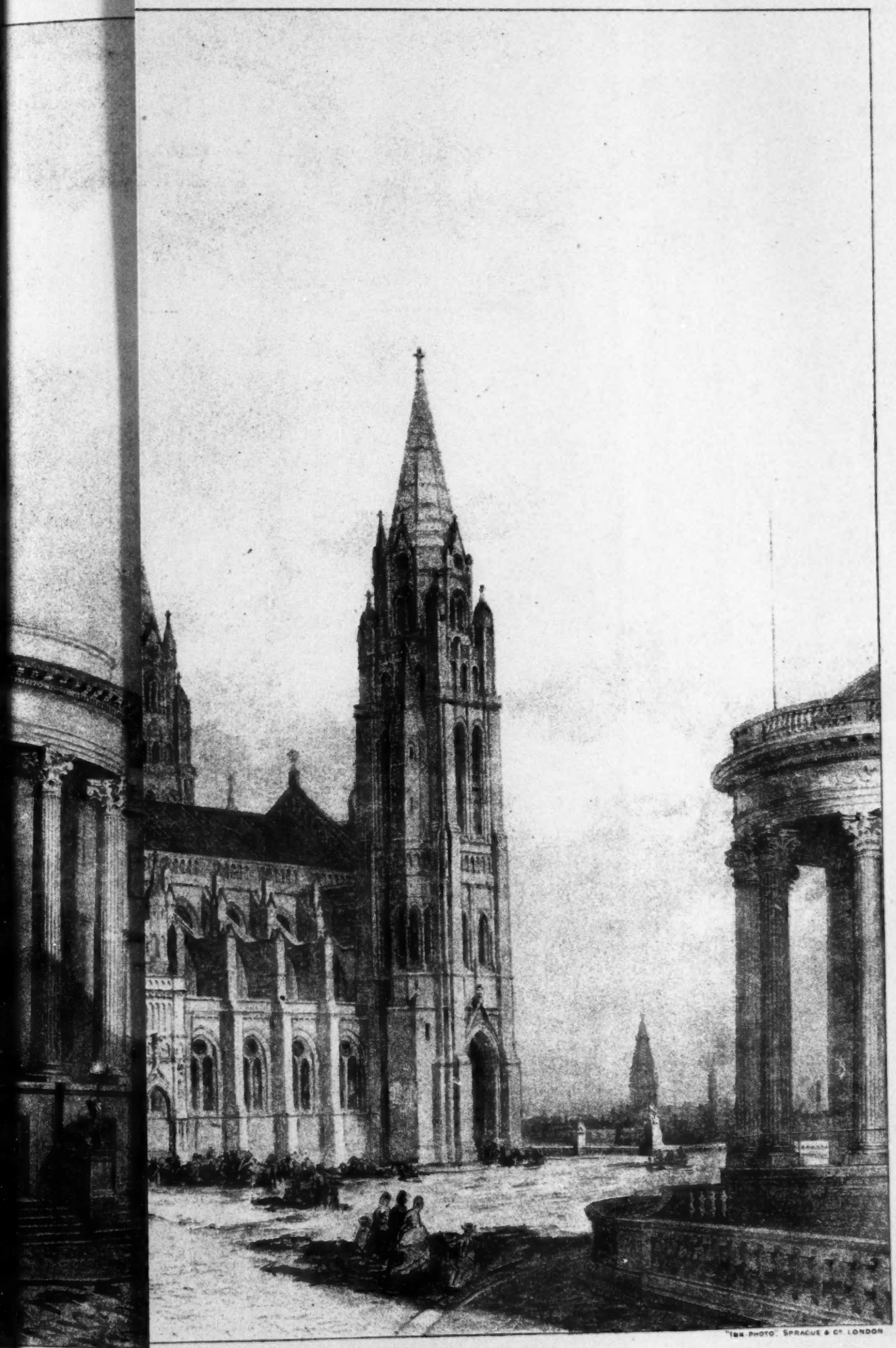
RESTORATIONS OF SOLOMON'S TEMPLE.

Illustrating Paper read at Architectural Association Meeting by Mr. E. C. Robins, F.R.I.B.A.



"INK-PHOTO." SPRAGUE & CO. LONDON.

NEW ENGLISH CHURCH, BERLIN.—HERR J. C RASCHDORFF, ARCHITECT.
VIEW FROM SOUTH-EAST.

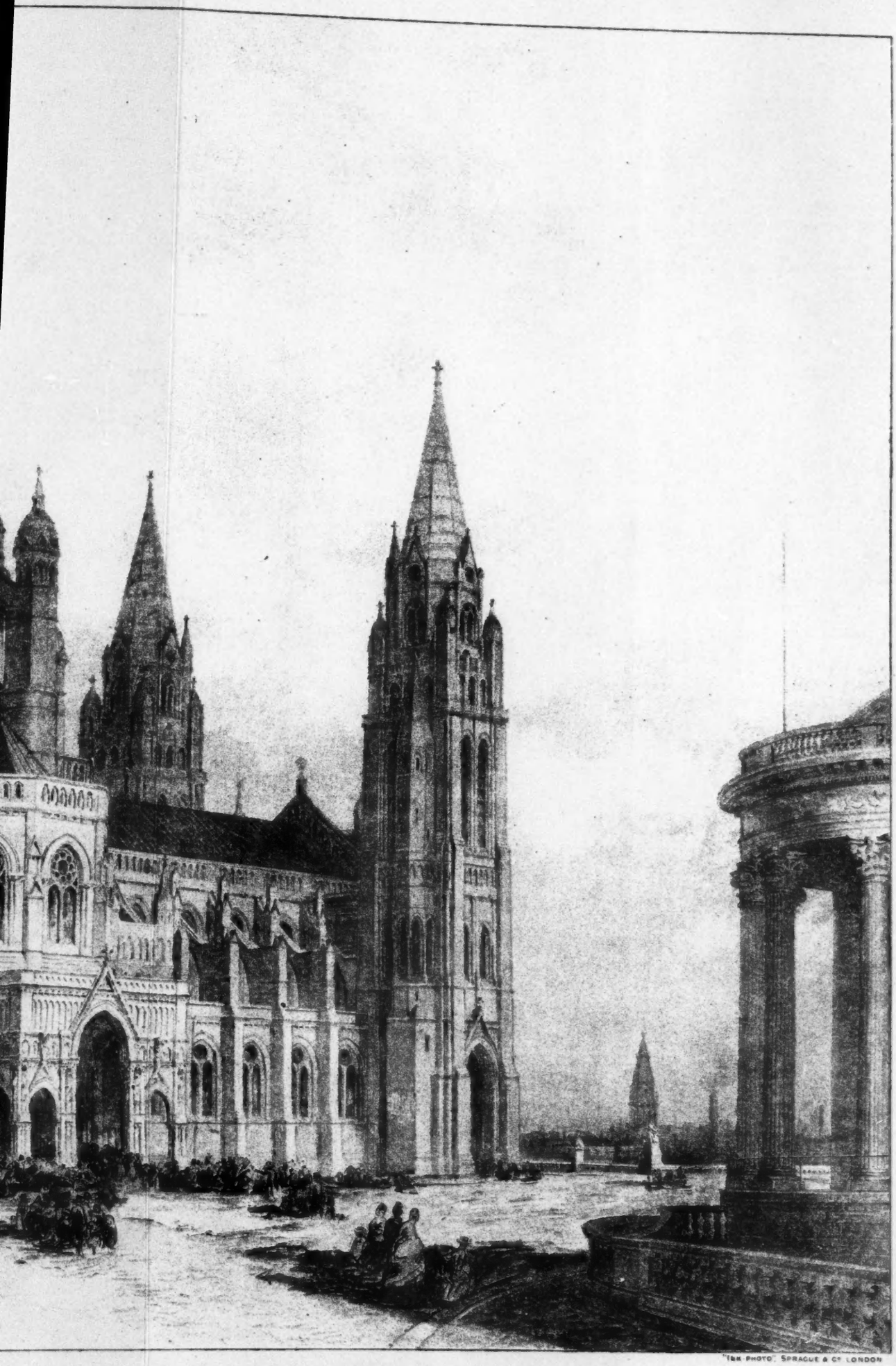


"IBX PHOTO" SPRAGUE & Co. LONDON

IERSON F R I B A.

LIVERPOOL CATHEDRAL COMPETITION.—Desi

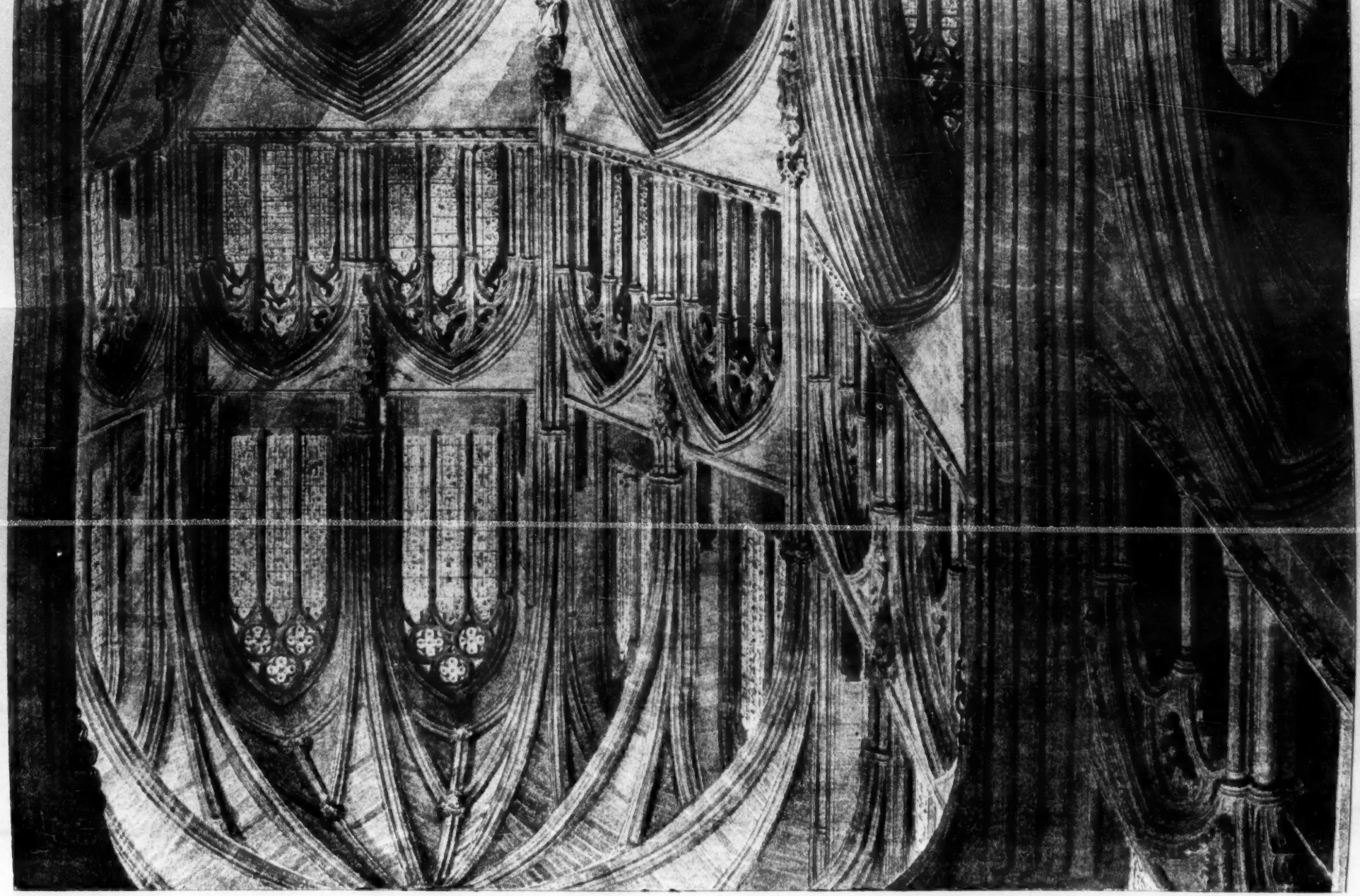
VIEW FROM THE NORT



"Ibx. Photo" Sprague & Co London

ESIGN BY MR. WM. EMERSON F R I B A.

RTH-EAST.



INK PHOTO. SPRAGUE & Cº LONDON

LIVERPOOL CATHEDRAL COMPETITION.—Design by Messrs. Bodley & Garner.

Interior View looking West, shewing Central Octagon.

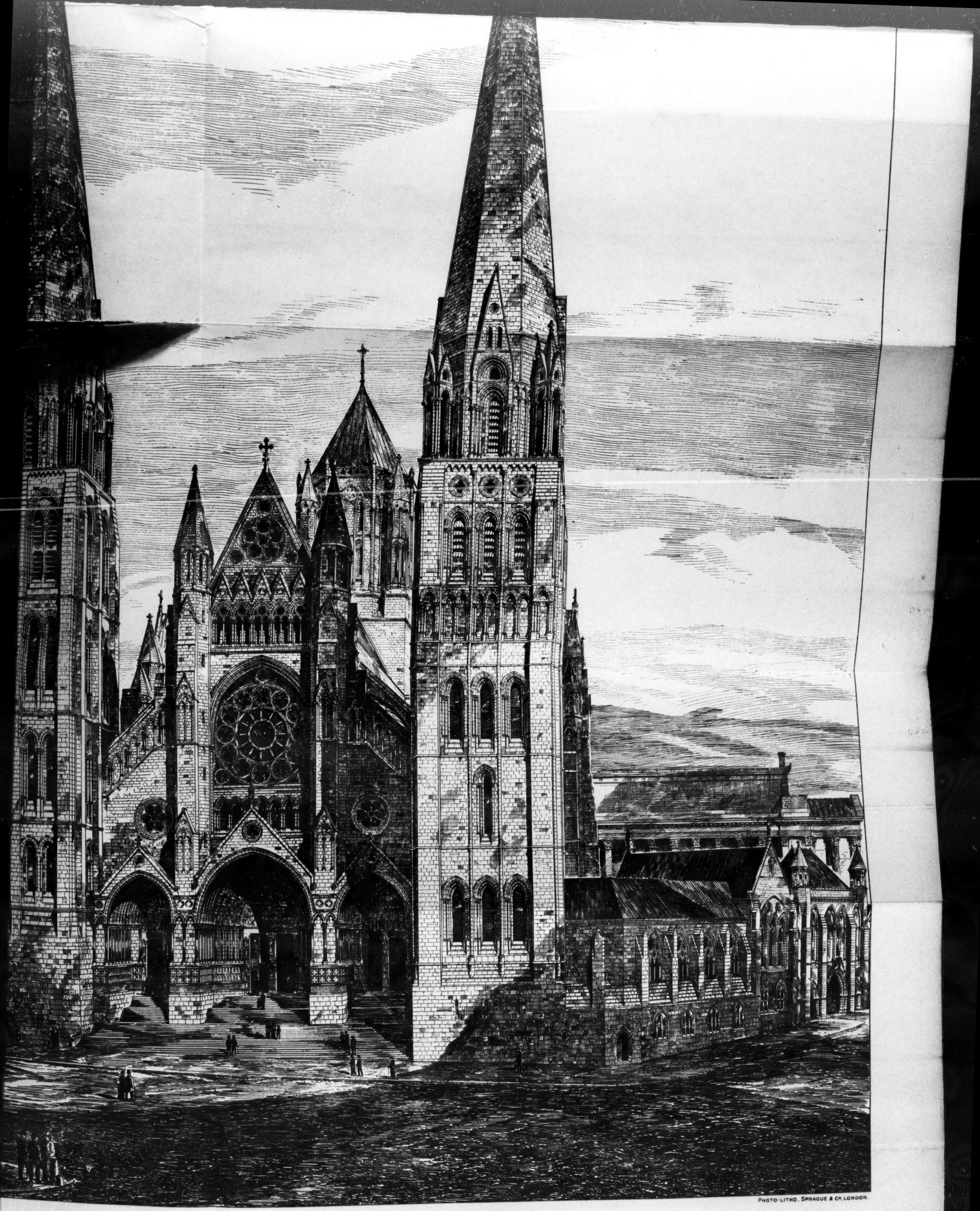
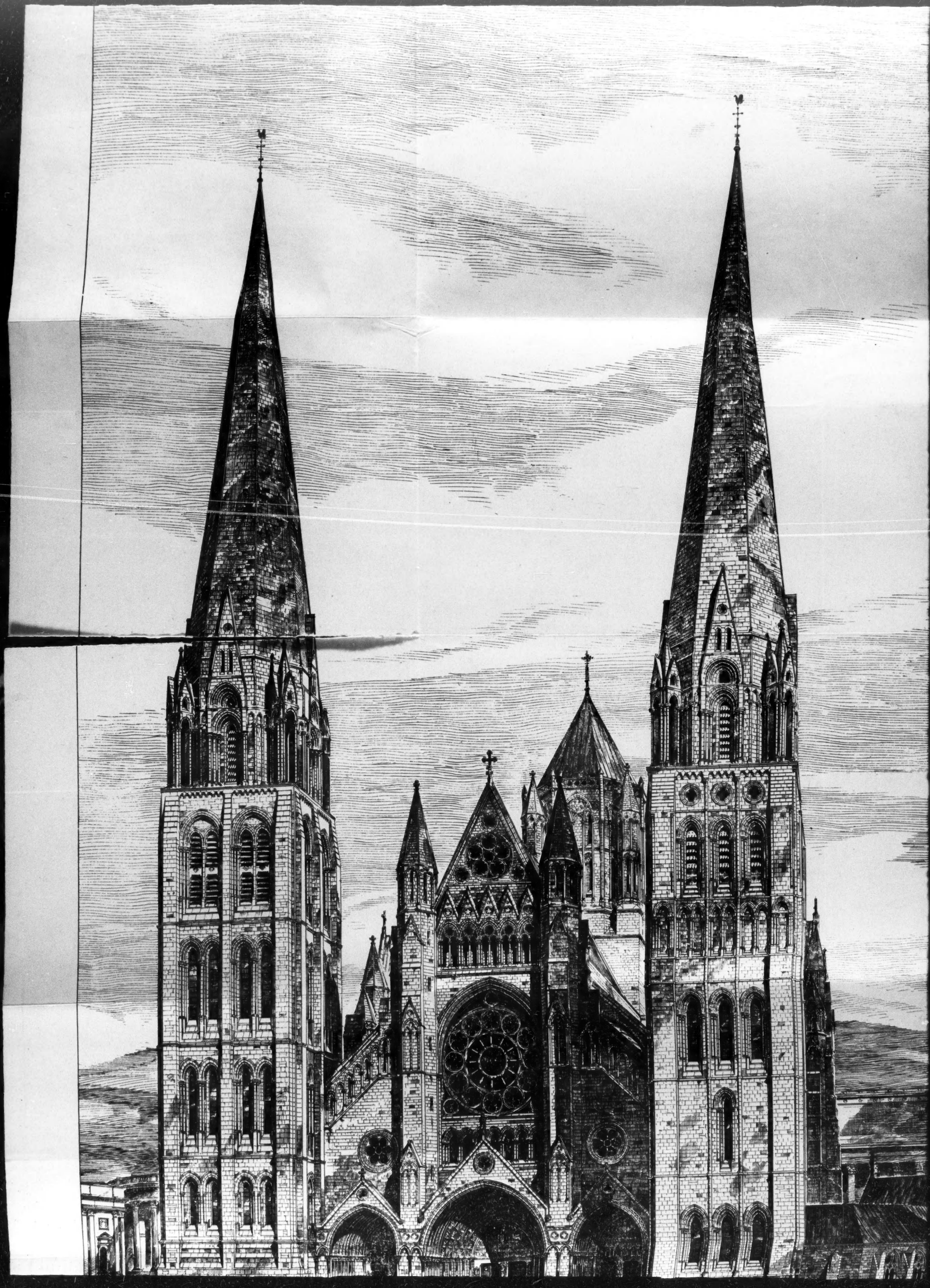


PHOTO-LITHO. SPRAGUE & Co. LONDON.

LIVERPOOL CATHEDRAL COMPETITION.—Design by Mr. James Brooks F.R.I.B.A.

View of West Front.



LIVERPOOL CATHEDRAL COMPETITION.—Design by Mr. James Brooks F.R.I.B.A.
View of West Front.

PLAN.

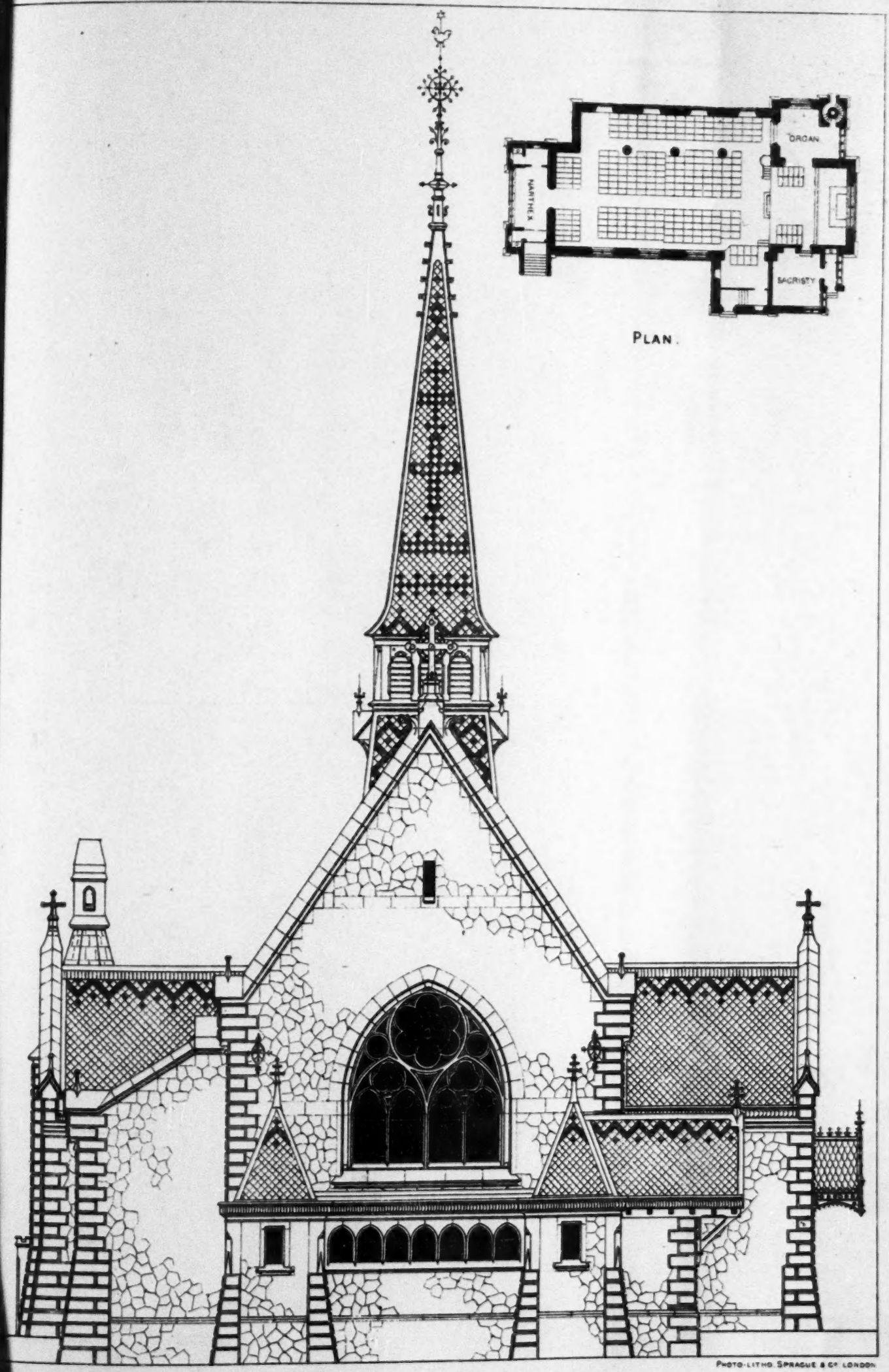


PHOTO-LITHO. SPRAGUE & Co. LONDON

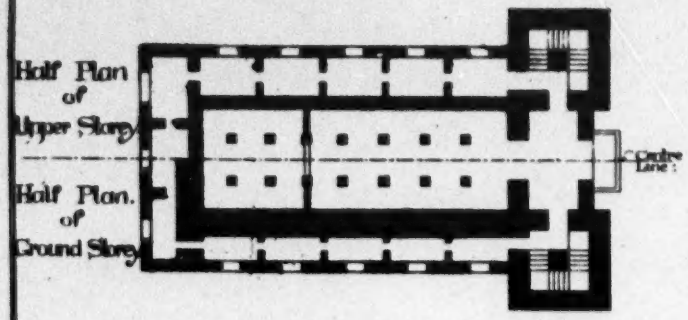
NEW ENGLISH CHURCH, BERLIN.—HERR J. C. RASCHDORFF, ARCHITECT.

WEST ELEVATION.

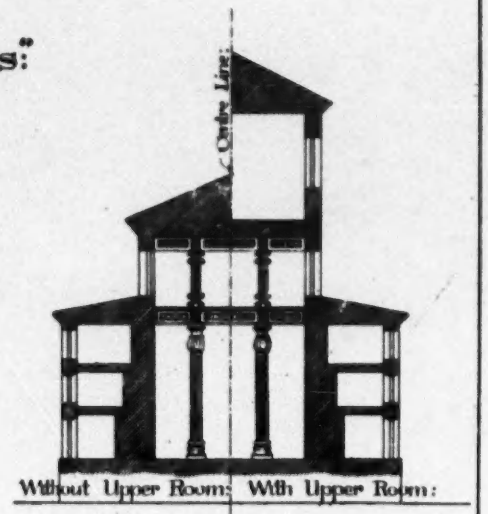
Fergusson's Third Design:

from the

"Temples of the Jews:"



Plan:



Section:

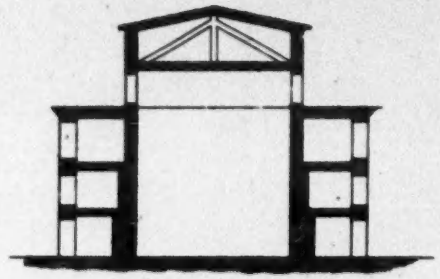
Fergusson's First Design:

from the

"Principles of Beauty in Art:"

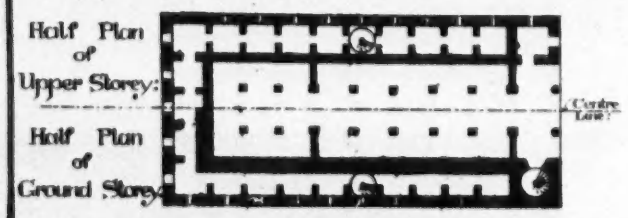
for the

Temple of Solomon:



Section:

Fergusson's Second Design:



Plan:

from the

"History of Architecture:"

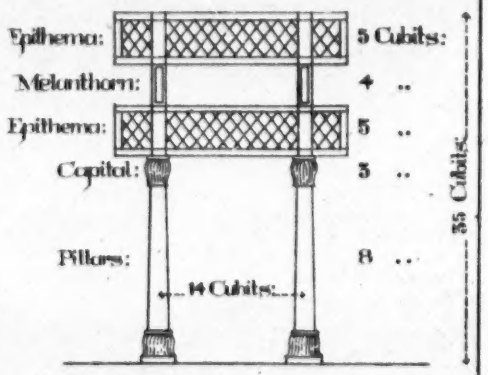
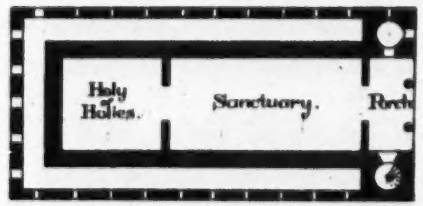


Diagram explanatory of Screen supported by the Pillars of Jachin and Boaz in front of Solomon's Temple:



Plan:

Wyman & Sons, Photo-Litho

C. Queen St. London, W.C.

RESTORATIONS OF SOLOMON'S TEMPLE.

Illustrating Paper read at Architectural Association Meeting by Mr. E. C. Robins, F.R.I.B.A.

THE TEMPLE OF SOLOMON.*

THE architectural form and style of the Temple of Solomon is a subject of inquiry interesting to all students of Biblical antiquities and literature. Much learned discussion has been expended upon it, and many volumes written to establish the views of their authors, some of whom have allowed their imaginations full play, making their wishes father their thoughts, and so have described a building or series of buildings, the like of which the world never saw for size, costliness, and general magnificence.

I propose to give some of the leading theories propounded chiefly by eminent architects, and to indicate also what appears to me to be the most reasonable hypothesis, the most probable form and style of architecture of that first building of which scarcely one stone remained upon another, even in the days of Herodotus, the Father of History.

The Jews were not a building people, and have left no native monuments but what are the result of forced labour in foreign lands. In this they were not singular, for their immediate neighbours, the Tyrians and Sidonians, have left no monuments either at home or abroad. Tyre, Sidon, Jerusalem, Baalbec, Palmyra, Carthage, possess no architectural antiquities anterior to Roman times, except, perchance, vast vasses of masonry, the retaining walls of imposing platforms upon which were reared those structures which have since disappeared.

The two great authorities on the subject are, of course, the Bible itself and the Jewish historian, Josephus. The first of these sources of information is the more reliable as regards the Temple of Solomon.

Josephus was well acquainted with Herod's Temple, and may be trusted in his description of that remarkable series of buildings, except, perhaps, as regards their height. Into his account of Solomon's Temple he imports his knowledge of Herod's, and gives to Solomon the credit of much that belonged to a later age. His example in this respect has been followed by subsequent writers and expositors, and thus there has been much idle speculation which could never have arisen had the 6th chapter of the 1st of Kings been the accepted authority for all subsequent restorers.

Take one curious example, viz., an illustration given in Stackhouse's large Bible, dated 1810. The observer is referred to the 6th chapter, 1st Kings, for an explanation of the plate, but the real key to it is to be found only in Josephus's "Antiquities of the Jews," with the addition of stairs and terraces mentioned in Chronicles, but considerably multiplied in number. The Temple proper rises above all, and is four times the height given in Kings, the whole being designed in the Roman manner of many centuries later. That the Jewish historian's style has favoured such theories as this, a single extract will suffice to show:—

After stating all that is given in Kings he goes on to say, that having built the Temple beyond the wall of the court surrounding the house in the form of a quadrangle, "Solomon erected for it great and broad cloisters which were entered by very high gates, each of which had its front exposed to one of the four winds enclosed by golden doors. But he made that Temple which was beyond this a wonderful one indeed, and exceeds all description in words; nay, if I may so say, is hardly believed upon sight, for when he had filled up great valleys with earth, which, on account of their immense depth, could not be looked on when you bended down to see them without pain, and had elevated the ground 400 cubits (600 ft.) he made it to be on a level with the top of the mountain on which the Temple was built."

Now, as a matter of fact, since ascertained by modern explorers, the lowest stone of the oldest wall of the present Temple area stands on the rock itself, and the summit of Mount Moriah is but 163 ft. above the rock upon which the lowest stone rests. That is to say, Josephus has quadrupled the height in his glowing description above quoted.

In short, this historian gives full play to his imagination whenever he can safely do so, as in speaking of the depth of valleys since filled up, or the height of towers since levelled with the ground. He rarely contradicts the sacred Scriptures, but rather omits or supplements them, or else takes advantage of some verbal discrepancy or peculiar mode of expression to introduce his own notions, whenever it serves his purpose so to do, or tends to exalt the glory of his people Israel.

Of Jewish religious structures, of course the earliest was the tent of the Tabernacle, the plan of which was divinely revealed to Moses at Sinai, and was never subsequently departed from; so that when Solomon built his Temple, in the year 1013 before Christ, he did not alter the general disposition in any manner, except that he doubled every dimension. And thus the Holy of Holies became a cube of 20 cubits or 30 by 30 by 30 ft., and the Holy place became 20 by 40 by 30 cubits or 30 ft. wide by 60 ft. long by 45 ft. high, and so on.

The *Temple which Ezekiel* saw in vision, 575 years before Christ, was identical in its dimensions with that of Solomon. Additional courts and passages were added, of which Canina and Fergusson have each made a restoration, shown on the drawings.

The *Second Temple*, as it is called, or Zerubbabel's (before Christ 520), which was built by the Jews on their return from the Captivity, likewise corresponded exactly with Solomon's building, but was shorn of its decorative splendour.

The *Third and last Temple*, erected by Herod, twenty years before Christ, is thus described by Mr. Fergusson:—"In this we have a perfect illustration of the architectural history of the country. The priests restored the Temple itself, not venturing to alter a single one of its sacred dimensions, only adding wings to the façade, so as to make it 100 cubits wide, and, it is said, 100 cubits high, while the length remained 100 cubits as before.

At this period, however, Judæa was under the sway of the Romans, and under the influence of their ideas the outer courts were added with a magnificence of which former builders had no conception.

An area, measuring 600 ft. each way, was enclosed by terraced walls of the utmost lithic grandeur, on these were erected porticoes unsurpassed by any we know of. One, the Stoa Basilica, had a section equal to that of our largest cathedrals, and surpassed them all in length; and within this colonnaded enclosure were ten great gateways, two of which were of surpassing magnificence. The whole making up a rich and varied pile worthy of the Roman love of architectural display, but in singular contrast with the modest aspirations of a purely Semitic people."

But I do not propose to enter upon the discussion of Herod's temple at all. The arguments in favour of Mr. Fergusson's views are great and manifold, and they are given *in extenso* in his splendid work on the "Temples of the Jews," to which I must refer you.

The important explorations in and about Jerusalem, which have been carried on since 1864 under the auspices of the Palestine Exploration Fund, are speedily coming to a close, without having revealed anything which materially militates against the views of Mr. Fergusson, Mr. Lewin, or Mr. Thrupp, who all agree that Herod's temple and associated courts extended to 600 ft. a side, and were situated at the south-western corner of the sanctuary or Haram area.

Solomon's Temple may have occupied the same area, as Mr. Lewin thinks, or much less, as Canina and Fergusson think; while it is most probable that Solomon's palace occupied the south-eastern corner, where are situated the sub-structures, commonly called Solomon's stables.

The majority of the drawings which I exhibit were prepared by me in the year 1858, and since that period I have been interested in observing the progress made in the elucidation of this subject, which, however, has resulted in the illustration of but few examples anterior to Roman times.

The great work, entitled "The Survey of Western Palestine," is being published, and therefore I have thought it a fitting time to have my "say" on the matter and to recall the earlier labours of others in the same field, so far as they throw light upon the main object of my inquiry, viz., the form and style of art employed in the construction of Solomon's Temple.

It will be desirable, however, to pass, very rapidly, in review the more important facts brought to light by the excavations of Captain Warren at Jerusalem.

Upon the Ordnance Survey of Jerusalem, made by Captain Wilson in 1845, I have tinted the famous enclosure called the Noble Sanctuary. It is described by Captain Warren as a raised plateau, measuring about 1,500 ft. from north to south, and about 900 ft. from east to west,—which is sustained by a massive wall, rising on the exterior from 50 ft. to 80 ft. above the present level of the ground.

The general level of this plateau is about 2,420 ft. above the sea, but toward the east, at the Golden Gate, it is not filled up to this general level by some 20 ft. or so. Almost in the centre of this plateau is an irregular four-sided paved platform, rising some 16 ft. above the general level of the plateau. About the centre of this platform the sacred rock appears, over which is built the celebrated Dome of the Rock, ascribed to the Moslem chief Abd-al-Melek,—but claimed by Mr. Fergusson as the Church of Constantine, erected over the Holy Sepulchre,—which Mr. Fergusson believes to have been in this position and to have been without the walls in Herod's time: a question upon which I express no determinate opinion till I have myself visited Jerusalem, but, in the meantime, as I stated in my letter from Rome to Mr. Barry (when President), which was published in the "Transactions" of the Institute of British Architects, there exist in Rome at this day circular temples strongly corroborative of Mr. Fergusson's contention.

Each of the three temples, as already observed, must have occupied the same site, which all admit was contained within the area of the present Noble Sanctuary.

Some authorities, says Captain Warren, as M. de Saulcy, Sir Henry James, the Count de Vogüé, supposed the whole sanctuary to have been occupied by the Temple and its courts, at least, in Herod's time.

Mr. Williams supposes 950 ft. square of the northern portion was thus occupied.

Messrs. Kraft, Robinson, Barclay, Kieport, and Porter think the Temple and its courts must have stood upon the southern portion of the sanctuary on a square of 925 ft. or thereabout.

Messrs. Tobler, Rasen, and others suppose the Temple to have covered a space about 600 ft. a side,—nearly co-incident with the present raised platform in the centre of the sanctuary, upon which site now stands the Mosque of Omar.

Captain Warren claims this position for the site of Solomon's Temple.

But I incline to the theory already referred to as that of Mr. Fergusson, Mr. Lewin, and Mr. Thrupp. And I think with them, that the successive temples occupied the south-western corner of the sanctuary,—while Solomon's Palace occupied the south-eastern corner. At all events, the most ancient remains are to be found in the walls at the southern end of the Haram area.

The result of the explorations adjoining the southern and eastern walls is as follows:—

The noble sanctuary enclosure being considered too sacred to be meddled with, especially by sacrilegious hands, shafts had to be sunk by Captain Warren at a distance of more than 20 ft. from the walls to reach the rock; horizontal galleries or tunnels had then to be driven therefrom to the base of the walls, which were founded on the rock, and appear to have been carefully wrought with drafted edges, and at one time to have been exposed to view.

I exhibit an enlarged drawing of this process, taken from Captain Warren's book, and also enlarged drawings of the elevations of the southern and the eastern walls, taken from the volume entitled "The Recovery of Jerusalem."

The lie of the rock is given below the accumulated earth above it,—showing the depth from which the walls spring, and from the carefully-dressed edge-drafted and bevelled masonry, it is reasonably conjectured that the whole of the wall was originally visible.

It will be observed that at the Triple Gate in the southern wall,—the rock rises to the sill of the gateway, and towards the east it inclines to the old bed of the river Kedron,—some 211 ft. in depth, or 107 ft. below the lowest stones of the wall at the south-eastern angle: and on the west side of the Triple Gate the rock descends to 90 ft. below the gateway to the old bed of the Tyropean valley, and rises again towards the upper city, being some 30 ft.

* A paper by Mr. Edward Cookworthy Robins, F.S.A., entitled "A Review of the various Theories respecting the Form and Style of Architecture of the Temple of Solomon," read before the Architectural Association on January 1st, 1886.

higher at the south-western angle, beyond which is shown the base of the pier which sustained the western side of Robinson's arch,—under the pavement of which is a drainage channel cut in the rock.

Below the present level of the ground are three successive pavements, showing the gradual filling up of the valley, upon the lowest of these pavements the fallen voussoirs of the arch have been discovered lying.

From the examination of this south wall, in nine separate places, there appears to be no doubt, says Captain Warren, that the whole of the stones below the present surface are bevelled or marginal drafted (though the faces are not all equally finely dressed) and that they are *in situ*——.

The courses of the great stones return along the western wall to Wilson's arch, passing the Wailing Place of the Jews, where some of the finest masonry is visible in what is called the Jews' Quarter.

Wilson's arch is about 600 ft. north of the south-western angle on the western wall, and marks the extent of Herod's Temple in this direction.

The restoration or reconstruction, or original foundation of the south wall by Herod,—from the double gate to the south-western angle seems a probable circumstance, prior to the erection of the Stoa Basilica, which extended to the triple gate, a distance of 600 ft., and marks the extent of Herod's Temple on the southern side towards the east,—thus confirming the correctness of Josephus's horizontal measures, who stated that the area occupied by Herod's Temple was four square of a stadium each side, or 600 ft. square.

This portion of the Haram area has a solid substratum. Beyond the triple gate the levels are raised on comparatively modern piers and arches, below which Captain Warren has discovered other passages and vaults, which lead him to surmise that the floor of the upper series of vaults rests on a lower range of piers and arches; but to what extent this may be the case has not yet been ascertained.

It is unnecessary for my present purpose to do more than indicate the position of Solomon's Temple itself. The courts surrounding it, doubtless, varied in succeeding times. Mr. Fergusson cannot stretch them so far even as the present south and west walls. Mr. Lewin, however, claims the whole of the Haram area as we now find it, not only for Herod's time but also for the Solomonic era; yet, as aforementioned, restricting the area of the Temple proper and its more immediate courts to the square stadium at the south-west corner; and he asserts that the rest is included in the statement that "Solomon built Millo," by which he caused the defection of the ten tribes who afterwards revolted under Jeroboam.

Canina provides a little over 600 ft. by 300 ft., and Mr. Fergusson considerably less.

Much of the eastern wall of the inclosure has evidently been the work of comparatively recent times, since the remains of former buildings are built into it, and the stone on which Mahometans believe that the prophet will sit to judge the world, is the end of a column, so treated, which projects from the face of the wall, not far from the Golden Gate, which belongs to the fourth century after Christ.

These remarks, having reference to the site of the Temple, will clear the way for what is to follow, viz., a comparative analysis of the various special designs made by different architects to illustrate the probable form and style of architecture employed by Solomon in the erection of the Temple building itself.

The theories of modern antiquaries may be conveniently divided into three classes:—

Firstly. The African, or those which assume that the Temple was designed on the model of Egyptian edifices, or in the Egyptian style.

Secondly. The European, or those which assume that it partook of the forms and design peculiar to Grecian architecture.

Thirdly. The Asiatic, or those which assert that it is to Phœnicia, Assyria, Babylonia, and Persia, we must look for the style of architecture employed.

In this cursory analysis of these several theories I shall endeavour, as far as I can, to describe each view in the spirit of the author's intention, the plans on the walls fully illustrating the same.

Firstly. The African.

Professor Hosking, in his Treatise on Architecture, prepared for the "Encyclopædia Britannica," thus expresses his opinion:—

"We think that the probability is great that the Temple was built in the Egyptian style, as far as the Jewish ceremonial would permit, and certainly the descriptions of its distribution accord better with that of an Egyptian than of a Grecian Temple.

The pillars Jachin and Boaz,—which are said to have been set up before the Temple,—correspond exactly in relative situation with the obelisks at the Temple at Thebes."

I have sketched a portion of an Egyptian Temple, showing the position of the obelisks with reference to the entrance,—but they do not answer to the description in Kings,—and it appears to me that the very names of the Pillars are sufficient to indicate their position as chief supports.

"Jachin, wherewithal it is established, and Boaz, in the which is strength." Akin to the pillars of Philistia, which sinewy Samson clasped in his fatal embrace.

Canina's Design.

The late Commendatore Canina of Rome took the Egyptian side of the question, and many years ago published a small folio work on the antiquities of the Jewish nation.

I have copied several of the geometrical drawings given in illustration of his views, to which I have added a perspective view to give full effect to what is certainly the most rational representation of the Egyptian theory (see lithograph plate in this number).

Canina agrees with Professor Hosking, that the two pillars were outside the porch of the Temple. Yet he does not suppose them to have been obelisks, but forms them into a portico in front of the porch.

The nets of checker-work and wreaths of chain-work for the chapiters, which were on the top of the pillars, seven for each chapiter, with two rows of pomegranates, 100 in a row, he supposes to have been in part the pattern of the capitals of the brazen pillars; and not a brazen network overhanging the lily-work of the chapiters, these he disposes in another way,—placing them in the cornice of the entablature connecting the two columns in his design, thus forming a porch or portico in front of the porch which alone is described in Kings.

Probably this view is based on the 19th verse, "And the chapiters that were upon the top of the pillars were of lily-work in the porch four cubits." Whatever these four cubits may refer to (which Mr. Fergusson originally ascribed to the intercolumniation, but which seem to me rather to refer to their diameter, elsewhere described as two cubits in circumference), it can hardly apply to the height of an entablature, or things so opposite as the supports themselves and the thing supported. And with reference to their position it is expressly stated that the chapiters, which were of lily-work, were in the porch, and not outside of it.

The height of the true porch Canina rightly makes the same as the sanctuary, but he has increased the length of the sanctuary by the thickness of the wall separating the oracle therefrom; whereas, in every description in the Bible, the whole length of the house is given as threescore cubits, and the separation of twenty cubits for the oracle was afterwards made.

The description in Kings, 21st verse, is, "Solomon overlaid the house within with pure gold, and he made a partition by the chains of gold before the oracle," in which bronze columns may have been introduced to carry the additional height of the end wall of the sanctuary.

Canina's arrangement of the chambers round the house I think most correct. Neither their number nor their length is given in Kings or Chronicles, though the former gives their width and height, while the latter does not mention them at all.

Ezekiel, in his vision of the restored Temple, tells us that "the side chambers were three, one over another, and thirty in order," that is, thirty in all on the sides of the house, besides those at the end of the oracle.

Our ingenious friend, Josephus, finding that the phrase "thirty in order," might be translated "three and thirty times," or thirty times three, says there were thirty chambers on each floor, in all ninety chambers,—it mattered not to him how small they were in plan, for what they lost in length he quadrupled in height.

The Count de Vogüé has been misled by him, and so was Fergusson in his earliest design.

The cubit measure is variously taken as 1 ft. 3 in., 1 ft. 6 in., and 1 ft. 9¾ in. long; but the successive Temples must have used the same measure. If the second Temple was built to cubits of 1 ft. 6 in. long, the first Temple was the same, the walls of the former being based on the foundations of the latter.

The letter of the adversaries of the Jews, addressed to Artaxerxes, during the rebuilding of the Temple in Ezra's time, favours this assumption thus:—"Be it known unto the King that the Jews which came up from thee to us are come unto Jerusalem, building the rebellious and the bad city, and have set up the walls thereof and joined the foundations"; literally, "sewed together the foundations," showing that they already existed, although the superstructure was burned to the ground by Nebuchadnezzar, at the time of the Captivity, who also carried away the Brazen pillars after he had broken them into fragments.

Thrupp's Theory.

Canina's restoration would not appear to be appreciated as it ought to be by those who favour the Egyptian theory, and in 1855 a work was published by the Rev. Mr. Thrupp, on "Ancient Jerusalem," containing some singular speculations on the probable form of the Temple. I have enlarged the plan given in his book.

Mr. Thrupp starts with the settled conviction that Solomon's Temple was like unto an Egyptian fane, that a parallel may be found in the Jewish Temple for nearly every peculiarity of the Egyptian. He details the several characteristics of the former, and endeavours to establish their coincidence with the latter. The body of the Jewish Temple he likens to the sekos of the Egyptian, and the chambers surrounding the house of the former to the galleries encompassing the latter.

In the Jewish porch he sees the prosekos of the Egyptian type. To obtain the necessary height, he adopts the 120 cubits given in Chronicles, while, to gain the required width, he resorts to his imagination, and says:—"The interior length of the portico of Solomon's Temple was 20 cubits, the same as the interior breadth of the sanctuary; but," he continues, "it may have been prolonged by lateral chambers or porticoes rising to the same height with it, and *may* thus, like Egyptian porticoes, have externally outflanked the body of the naos."

In the pillars Jachin and Boaz he finds traces of the Hall of Columns; but as he dare not attempt to add the one, no place is left for the other, so that the unfortunate pillars are left out altogether.

The Court of the Priests he converts into a propylon, surrounding it with pillars in the first place, and with chambers in the second.

Finally, he recognises the large pyramidal towers in front of Egyptian temples, in an imaginary eastern front to the Court of the Priests.

The Count de Vogüé's Design.

The latest resuscitation of the Egyptian style, as the type to be followed in restoring Solomon's Temple, is by the Count de Vogüé, the author of the "Syrian Antiquities," who has published a work on "Jerusalem and its Temples." His design for the Solomonic Temple throws little light on the subject.

His main façade consists of a large Egyptian pylon, with an opening in the centre 20 cubits square, in which are situated the Pillars Jachin and Boaz, the ornamentation of the capitals containing the lily work and pomegranates. The porch is 10 cubits deep by 20 wide, and 60 cubits high, while the rest of the massive pylon appears to be solid, except where the staircases to the chambers occur on each side.

He adopts Josephus's number of chambers forming a series of dark closets.

He makes the Holy of Holies a cube of 20 cubits, but the height of the Sanctuary is reduced from 30 cubits to 17 cubits, by the introduction of an upper chamber, and thus no light is admitted to the Sanctuary, any more than to the Holy of Holies.

Secondly. The European. Prof. Wilkins' Design.

Passing to the second section of the subject we come to consider the views entertained and

advocated by the accomplished author of the "Prolusiones Architectonicæ."

"The chief object of the present essay" (says Professor Wilkins in his essay entitled "The Temple of Jerusalem the Type of Grecian Architecture") "is to show the influence produced on the Arts by the commencement and accomplishment of this great enterprise, and the example it afforded to the architects of the ages immediately following, as yet unskilled in architecture, and wanting some type of great authority for their guidance."

"If we compare," says he, "the plan and proportions of the Syrian Temple with those of some of the earliest examples of Grecian origin, such, for examples, as those at Pæstum and Egina, a resemblance will be found to exist that can only be attributed to the adoption of the same principles by the architects of Palestine and Greece" (see Illustrations).

On the assumption that the Jewish cubit was equivalent to 21·888 in., the extreme length of Solomon's Temple, by a little stretching, is made, in his restoration of it (see Plate), to agree with that of the Temple of Pæstum within 2 in., and to be of the same width within 3 in.

To achieve this result, however, passages have been introduced to eke out the thickness of the walls of the house, and the end chambers are made deeper than the side chambers.

But these narrow passages in the thickness of the walls serve a double purpose; they are substituted for the "windows of narrow lights." There being commonly no windows in ancient Grecian temples, Professor Wilkins has felt it incumbent upon him to show that none necessarily existed in Solomon's Temple; and he quotes a passage from the Odyssey, where the same word is translated "intervals," interpreted by him to mean "narrow passages in the thickness of the walls."

To make the total height agree with the usual proportions of a Grecian elevation, he considers the length and breadth of the house, as given, were internal dimensions, and the height was an external measure. By this arrangement he contrives to make the sanctuary, and the oracle and the porch, of equal external height, whereas the first is distinctly stated to be 30 cubits high, the second 20 cubits, and the third is not given at all in Kings, and is exaggerated in Chronicles by the curious multiplication of the height of each of its sides.

By adding 5 cubits for the roof, and 5 cubits for a raised floor, and deducting this from the 30 cubits given as the height of the sanctuary, it is made to agree with the internal height of the oracle. By further adding 2 cubits to the height of the side chambers, these also are made to fall in and range with the rest, and the general conformation is complete. In the number of chambers he follows Josephus, and provides thirty on each floor.

We now come to the celebrated pillars in the porch, but where are their chapiters of lily work and pomegranates? As no early Greek capital was ever 5 cubits deep, these also had to be got rid of; and as, moreover, an entablature and pediment was indispensable to make the resemblance complete, the learned Professor proceeds to provide them in the following ingenious manner.

He first gives a translation from the Septuagint text, which runs as follows:—"And he made two epithemata of molten Brass, to place them upon the capitals of the columns, 5 cubits was the height of one epithema, and 5 cubits was the height of the other epithema." And then explains that the architectural term epithemata, translated chapiters in our version, properly means some numbers placed over the capitals, and not only the whole entablature, but the pediment of a building also; and that the words in Kings translated, "Upon the tops of the pillars," should be rendered "Upon the capitals of the columns."

Mr. Fergusson has also taken advantage of this suggestion, since he has needed arguments to support his latest idea, viz., the likeness of the pillars and their appurtenances to the Indian toran.

Now, we have all heard it said that the Doric order originated in the petrifaction of wooden forms of construction, and that the pediment grew out of the sloping timbers of the roof; the triglyphs being suggested by the ends of the tiebeams; but Professor Wilkins believed that neither wood nor stone was the material of the original type, but molten brass.

As for the brazen network and pomegranates encircling the chapiters, these he suspends from the epithemata, and to them refers the origin of the guttæ in the Doric and Corinthian orders.

Then as to the "lily-work of the chapiters," he suggests that this was an ornamental fascia, resembling the painted ornament so frequently found in Grecian temples; and in this way every distinctive peculiarity of Solomon's Temple is merged into that of a succeeding period, of which it is proclaimed the type.

Hakewill's Design.

With passing remarks upon the views of Mr. Hakewill, as published by him in 1851, we will conclude this notice of the European side of the question (see Illustrations).

Mr. Hakewill follows up Professor Wilkins, but is much less scrupulous than he, and wonders that the learned Professor "should have so clearly seen and proved the fact of the resemblance with the Greek temples, and yet following Villalpandus and Le Roy, should have suffered the question of chambers, in reality, so to mar his theory, as to leave no resemblance in his illustration."

Therefore, suiting the action to the word, he defines the word "chambers," in our translation, to really mean "defined and limited space"; and the word "window" to stand for "means of light," and sweeps the side chambers and the narrow passages, substituting a peristyle of columns for the outer walls, with a wooden screen formed against them inside, which he continues all round the building, and even in front of the porch, and then very naïvely remarks, "The close similarity between this and the universal form of the Greek Temple is too obvious for remark." *

THE POLLUTION OF WATER SUPPLIES.

AT the January meeting of the Association of Public Sanitary Inspectors, held on Saturday evening at No. 1, Adam-street, Adelphi, an important paper, on the "Pollution of Rural Water Supplies," was read by Mr. James Bateman, C.E., Surveyor of the Eveleigh and Pewsey (Wilts) Local Board, before a large audience of inspectors and visitors. The Chairman of the Council, Mr. G. B. Jerram, presided. The paper was illustrated with plans drawn to a large scale, showing the defective construction of existing cesspools on the farms of a district which supplies London with enormous quantities of milk daily, and exhibiting improved forms of cesspools effectively ventilated.

Mr. Bateman, in his paper, admitted that the question of water supply was one for the engineer rather than the sanitary inspector, but held that at the present day the latter official should know enough of hydrostatics and mechanics to report upon and suggest at least temporary remedies, in pressing cases of failure or contamination. Sanitary science was almost totally unknown in the rural districts, and the provisions of the Public Health Act of 1875 were, in the lecturer's opinion, totally inadequate. Villagers whom he could name depended almost exclusively upon a well in a churchyard for their drinking-water; and last summer, this failing, they were compelled to travel a distance of five miles for the water required for domestic purposes. The samples on the table were fair specimens of that obtained from the domestic wells of the whole town of Pewsey, an unpolluted well being a rare exception. They were contaminated with soakage from manure heaps, piggeries, privies, and land dressings generally. The earth-closet system, as a remedy, had been a failure, in his experience,—the tenants being unable, and the sanitary authorities unwilling, to incur the expense of making it effective. The present depressed state of agriculture almost precluded the hope that anything would be done to remedy these serious defects by private individuals, but it was imperative upon sanitary authorities, the custodians of public health, to supply one of the first essentials of healthy life,—a pure and wholesome water. In many other counties of the west, besides Wilts, the water supplies were equally scanty, foul, and filthy, and, in some districts where the cloth manufacture was carried on, the streams themselves were highly polluted, the Rivers Pollution Act seemig to be more honoured in the breach than in the observance. Of the Green Pump at Calne Professor Stoddart had reported as follows:—"The water is of a yellow-brown colour, full of suspended matter, consisting of iron dust and partly of flocculent organic matter, with infusoria and bacteria." The Abyssinian tube-wells had been tried in some places with partial success, but in no case within the lecturer's experience had an adequate supply been reached. He did not say the system was at fault, and he thought a better result would have been obtained had Messrs. Legrand & Sutcliffe, or other persons as competent as they, been employed to sink wells. The Rivers Pollution Act scarcely went far enough. Penalties were only inflicted where new drains were turned into the water-courses, but the old drains went scot free. The volume of sewage was being added to every day by the connexion of new drains, and one of the most valuable sources of water supply was thus becoming more and more contaminated. The question had an important aspect for Londoners. A large tract of country extending between Reading and Trowbridge, the Kennett and Avon Canal, and the Berks and Hants extension of the Great Western Railway, which formerly was exclusively devoted to corn-growing, had been turned into pasture land, the corn farms becoming dairy farms for supplying milk to the various milk companies of London. The farmer had altered the character of his farming, but he forgot then to change the noisome surroundings of his homestead. The hollowed centre of the farm-yard formed a gigantic cesspool, filled up with the manure of the pig-styes, stables, and stock-sheds, and the rotting mass was constantly churned up by the passage of cattle over it. The rain-water from all the roofs discharged itself into the mass, which became by constant accumulations a large pool of most offensive liquid sewage that in time filtered through into the well, from which the supply of water both for cattle and man was exclusively drawn. The most scrupulous cleanliness was observed in the cow-houses and the dairy. In the course of a tolerably long experience the lecturer had never detected a sour or dirty churn, and the refrigeration of the milk and its carriage were carefully carried out, but it could not be wondered at that the tenants were subject to diphtheria or that the medical profession should be occasionally baffled by the outbreak of diseases of mysterious origin. The first of the remedies he would recommend was the placing of the cowhouses under the inspection of the sanitary officer instead of under that of the county police. The police were an excellent body, but not qualified for an important duty demanding a really technical training. There should also be a stricter supervision by the metropolitan dairy companies, and a determined opposition to the reception of milk from any but those farms which had been certified by the sanitary authority as being properly drained and having a pure, wholesome, and sufficient water supply. Until that became law there must be periodical outbreaks of disease.

In the discussion which followed the Chairman, and Messrs. Boulter (Bexley), Poulson (Chelsea), Alexander (Shoreditch), Middleweek (Kensington), Rumball (Barnet), and Dee (Clapham) took part.

THE ALBERT DOCK.

THE enormous trade of the Port of London makes everything connected with the development and extension of its stupendous docks a matter of wide and really national interest. One of the most powerful of these dock companies owns the London and St. Katherine and the Victoria and Albert Docks, as well as the Cutler-street Warehouses and the East Smithfield Railway Depôt; and has invested in these vast undertakings a capital of over ten millions of money, upon which, even in these times of commercial depression, and in these gloomy days of the shipping trade, a dividend of over three per cent. is earned and paid.

The tendency of all the new dock extensions is progressively towards the sea. The Victoria Dock was the first step down the river, and by that work a great bend of the Thames was avoided. The direct extension from that fine shipping haven was the enormous Royal Albert Dock, opened for the admission of ships in 1880. By this vast engineering work a broad peninsula was cut across, and another bend of the Thames

* To be continued.

avoided, vessels entering the new dock 11 miles down stream. The particular locality of a dock in respect to the trade and warehouses of the City has very important bearings on its influences as well as on its own returns of profit and its commercial success. And as the various dock enterprises now in execution are brought so far towards completion that the trade and traffic with them are commenced, many features of value are brought out in strong relief. This is particularly striking in the present instance of the Albert Dock. Its distance from London is not too far for cartage or lighterage. City merchants have already found that, once their goods are loaded in their vans, it is cheaper and more expeditious for their horses to draw them the whole journey than to re-load into barges or on to the railway trucks. Again, in the case of wool, the total annual importation amounts to about 1,100,000 bales, of which the London and St. Katherine Docks and two wharfingers take one million bales. As the warehouses at these docks are handy for merchants to inspect and sample the goods, it is of the greatest advantage to the Dock Company to have their warehouses remain the customary depôts for this commodity. The easy distance between the Victoria and Albert and the older London and St. Katherine Docks permits of barging between them. The trade brought already by the large Australian and other steam-ship lines is of great magnitude, and it is of the highest importance to facilitate the arrival and departure of the immense vessels now employed in the ocean-carrying trade. Hitherto, both entrance and exit have, since the opening of the Albert Dock, had to be conducted through one and the same channel, the outgoing ships having the precedence of coming out on the flowing tide. The original design of the Albert Dock provided two locks from the river into the outer or Galleons Basin; and it was the engineering works of the second entrance that a large party of practical visitors were on Monday last invited by the chairman and directors of the Dock Company to inspect. The Act of Parliament authorising these new works was passed in May, 1884, and the entire undertaking, it is expected, will be completed early in the spring of the present year. The new works consist of an extensive enlargement of the Galleons Basin, giving an additional water space of some fifteen acres, with two additional berths for the largest steam-ship liners; a second entrance from the Thames by means of a lock 550 ft. long and 80 ft. wide contiguous with and parallel to the existing entrance, but with this difference, that the new lock has a depth of 36 ft. below Trinity high water, or 6 ft. more than the present one. Besides this there is, branching off from the new entrance into the river, a very fine landing-stage with a river-front parallel with the shore extending for a length of 1,120 ft. down the Thames, and having a depth of water alongside of 27 ft. at low water. The passenger traffic between London and the Albert Dock is carried on by four trains an hour each way between Galleons Basin and Fenchurch-street, and amounts to an annual total of over two millions of passengers. The railway lines are being carried right on to this river wharf, so that passengers may have the facility of landing as soon as the ship arrives at the pier, and then taking train on the spot, save some notable time by proceeding immediately on their forward journey, over what they would be able to do if the dock or the basin had to be entered. Equally will facilities of latest embarkation be afforded by the river wharf, as well as opportunities of discharging at the earliest, or despatching light or perishable goods at the latest, moments. There is one very valuable feature in the construction of this river-wharf, viz., its division at intervals by walls of concrete and brickwork as a protection from fire. The river shore inside the wharf has also been thoroughly well embanked. The excavation for the lock has been made in clay, peat, sand, and gravel, and over 500,000 cubic yards of soil have been removed and deposited on the company's land.

The great sumpt for the drainage of the engineering works has been carried down to a depth of nearly 60 ft., and enters the chalk. The pumping is effected by four 24-in. pumps, throwing out 1,000 gallons per minute. The lock and basin walls are of concrete, faced with vitrified bricks, the quoins and cills and copings being of Cornish granite, There are three pairs of iron lock-gates, which are being built in position, and these will be opened and closed by hydraulic power. The roller-paths are made of cast steel. The invert of the lock is formed of seven rings of bricks strengthened by concrete, and under the entire lock there pass four culverts for the conveyance of drainage and the service of the gas pipes and electric wires.

The works have been designed and carried out by the General Manager and Consulting Engineer, Colonel Martindale, C.B., R.E., and Mr. Carr and Mr. Thomas, the Company's Engineer. The execution of the lock has occupied a little over eight months, and stands, for rapidity of accomplishement, probably the first in speed of any such work on record. The perfection of the construction reflects the greatest credit upon all concerned.

The works have been protected from influx of the river by a copper dam across the mouth of the lock-entrance, whilst at the rear they have been defended against the water in the basin by a concrete wall 20 ft. thick at its base and 530 ft. long. This wall is in process of being blasted away; the final *coup* it is intended shall be given by about a thousand shots fired simultaneously by electricity.

LONDON DRAINAGE.

MEDICAL OFFICERS AND ENGINEERS.

IN the current number of "The Asclepiad," a book of original research in the Science, Art, and Literature of Medicine, preventive and curative, and which is written entirely by Dr. Richardson, F.R.S., there appears an article on the drainage of the metropolis, headed "Under London: a Prospect for Radical Reconstruction."

The main points raised in the article are:—

The advocating of a dual system of removal for sewage and storm-water by the introduction of iron sewers, for the sewage, to be inserted in the existing sewers, which are proposed to be used for storm waters only, and the application of an exhaust in lieu of water as a sewage carrier.

The remedies for existing evils are drastic.

The word-picture is dramatic, being written in that forcible and lofty English which attracted so much attention to the same author's "City of Hygeia."

Dr. Richardson makes complaint that the existing state of the drainage question is due to the interference of engineers in matters medical, in the following words:—

"If our engineers had kept to their own splendid department of science, instead of assuming the position of doctors of health, or if the latter had been stancher at the first, all the present trouble might have been saved. By reverting to their true positions and functions, both can make a magnificent *amende*."

A reply to the article has been addressed to Dr. Richardson by Mr. Ellice-Clark, M. Inst. C.E., of which we print the first part:—

"*To B. W. Richardson, esq., M.D., F.R.S.*

Dear Sir,—I have read your article, 'Under London,' in 'The Asclepiad,' with that interest and attention which not only the importance of the subject must command from sanitarians in general, but also with that desire which is possessed by myself, in common with most municipal engineers, to advance the present system of removing the voidance of great cities, and to bring the practice of that removal nearer the ideal of the more advanced professors of preventive medicine, of which you may be deemed the foremost.

You will pardon me, if the remarks which I presume to make on your paper, are prefaced with a dilation upon the inferential conclusions drawn from the statement, that engineers trespass upon the work of doctors of health.

A knowledge of the facts as they exist in provincial towns enables me to draw different conclusions to those you appear to hold on this subject. If you take those great centres of population, where the doctors of health have as complete a knowledge of preventive medicine as can yet be obtained, you will find that, so far from the engineer having strayed over the border of his own professional area into that of preventive medicine, too often the reverse has been the case.

No doubt, there are examples of municipal engineers undertaking work which properly belongs to the municipal doctor, but this interference on both sides depends very largely upon individuals. Nor must it be forgotten that while the Borough Engineer has had an existence of nearly half a century, the creation of the Medical Officer of Health is comparatively recent. In the latter's absence, the municipal engineer was, from the very exigencies of the case, compelled to intermix some of the well-known facts and theories of preventive medicine with those of engineering, in public reports, in order to prove the necessity of sanitary works to those who governed, and who too often were special pleaders for the *status quo ante*.

Further, let it be mentioned, with that deference and admiration which high attainments must command from all thoughtful men, and which brethren of appreciation, have been ungrudgingly given by engineers to many eminent men in your profession, who have brought the study of preventive medicine to its present standard, that it is no exaggeration to say more than seventy-five per cent. of those who have been called upon, often reluctantly, to fill the office of Doctor of Public Health, have not only had no technical knowledge of their work, but there was until lately, no literature out of which a knowledge could be built up; and while the medical schools continued to ignore the claims which this branch of the profession had upon them, it was by no means astonishing.

One may venture to think that such an interference as you describe is inborn of the practice of all sciences which are still in their infancy.

Probably had not the Doctor practised Sanitary Engineering and the Engineer practised Preventive Medicine, the pre-eminence of England,—such as it is,—in public health matters, would as yet be an unaccomplished fact,—certainly, it would have not attained anything like the standard of efficiency it has at the present time.

It may be that the time has now arrived when this practice of engineering by doctors and of doctoring by engineers, should cease, although an intimate acquaintance with a majority of the local officials of this country does not hold out the hope that this desirable consummation can yet be brought about with advantage to the community. Indeed, it cannot be so until the State insists upon every doctor of health and every engineer of health proving fitness, by a test examination, of the necessary qualifications for their respective offices.

It would appear incredible, were it not demonstrated to every-day understandings incessantly, that men should be appointed to offices requiring special and complete knowledge in special and complete brains, without any test whatever as to their possession of even the elementary principles of such special knowledge, or of such special brains. No one would be accused of exaggeration by those who know, if they stated that half of those appointed, at the inception of their public employment were in the former case.

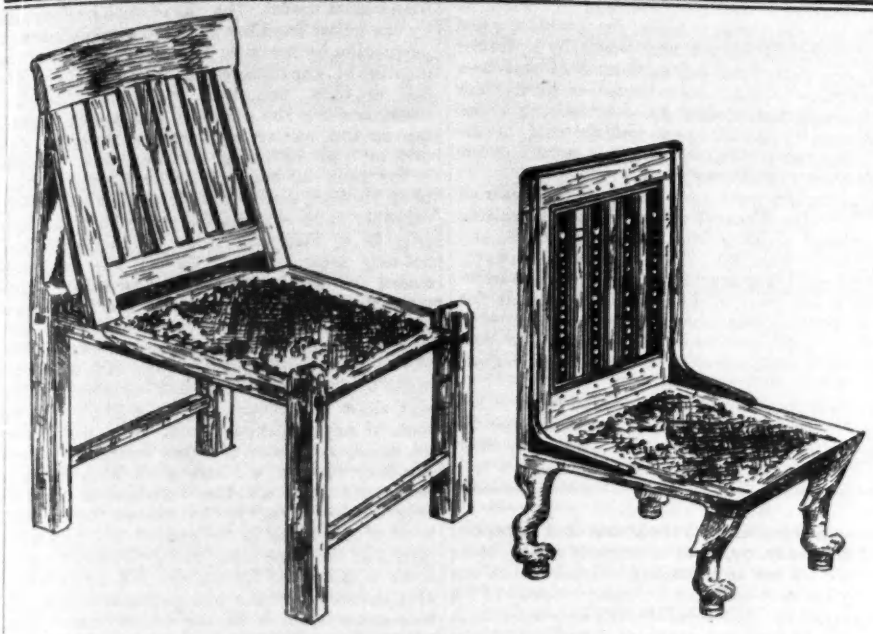
This statement is not made by way of reprisal,—it, alas! applies equally to my profession and your own. Municipal engineers would indeed be living in that metaphorical structure, a fool's paradise, and be devoid of that practical common-sense with which they are accredited by the public, as the outcome of their work in the most practical of all the professions, if they made any attempt to place all their existing order on a high platform of efficiency. We know too well how these appointments are made, and by whom, and how often sinister influences are brought to bear to secure the services of those who are miserably incompetent, so that their employers may have some excuse for ill payment, and we should raise a false issue if we declared that competent men now filled every office.

That will not, however, prevent us from seeing ourselves in a shade of light only a little darker than that in which others see us, and of endeavouring to raise the now much too low standard of efficiency in the rank and file of the municipal engineering army.

These remarks are intended to apply to provincial places and not to the metropolis. To many of us unsophisticated provincials it is news to hear that there is any friction between the engineer and the health doctor of the overgrown and still-growing Babylon. In the first place, we were not aware that municipal government had reached such a high stage that there was any individual who had committed to his charge the task of directing the practice of preventive medicine for the metropolis; and if conflict there be between professors of public hygiene and engineers, it must be outside the charmed circle of chief officials. That there are great, grave, and deplorable defects in the administration of municipal engineering in London, we provincials are well aware, and that there is ample room for the complaint of doctors of health any wet week in London makes filthily apparent; and you may like to be advised that we do not set a higher value on the metropolis sanitary engineering than it brings in the open market of public opinion.

Such a conflict as you assume is being waged between engineers and medical men in London is well understandable when it is remembered that London has in reality no municipal government,—that is, no municipal government as is meant by that term in the provinces. It would be strange, indeed, if there was not conflict of opinion, aye, and conflict of practice, between officials themselves, and between officials and outsiders in such a disintegrated, hotch-potch medley of government as misrules London.

Looking at the question apart from local considerations there now exist, except in the isolated cases named, no reasons why Captain Engineer and Captain Doctor should not each sail his own ship on his own course. The line of demarcation between



Two Egyptian Chairs

the work of such officials at all points is not very clearly defined,—but sufficiently so to keep each ship out of collision. It only requires that mutual forbearance between individuals, without which success cannot be attained in any walk of life. We believe, at all events, so far as the provinces are concerned, not only has the 'magnificent *amende*' of which you speak, been made, but that as complete harmony prevails as is practicable where matters mundane are governed by erring humanity.

Brighton." E. B. ELLICE-CLARK.

Dr. Richardson's article is well worthy of perusal by all municipal engineers. "The Asclepiad" is published by Longmans.

TWO EGYPTIAN CHAIRS.

THESE two chairs, which are in the British Museum, are here reproduced from drawings by Mr. J. H. Eames. The larger one has a very purpose-like and remarkably modern appearance, and both, except the seat portion, are in wonderful preservation, considering their age.

THE FORTH BRIDGE.

SIR, — There is a correction of a personal nature in your otherwise very satisfactory notice of the Forth Bridge works in last week's issue [p. 10] which I should like to make. The name of my partner, Sir John Fowler, K.C.M.G. (now on his way to Australia in search of more sunny skies) should have preceded my own as chief engineer of the work. B. BAKER.

Westminster, January 2, 1885.

QUANTITIES.

SIR,—It is impossible silently to pass over the anonymous letter from "A Suburban Builder," contained in your last issue [p. 64]. The items referred to are maliciously misquoted and understated, and, were it not for their misleading character, would have been passed over with the contempt they deserve. I may state that great stress was laid by the committee upon the tenders being in by the first week in January, so, owing to short time for preparation, abbreviation had to be adopted; still, the only part of the bill mentioned by your correspondent that exception might be taken to is the last, viz., the mitres to dado being omitted, and a glance at the drawings would suffice to explain their number. The latter are fully detailed and figured, and with the specification no competent builder need have any difficulty in thoroughly understanding the work in the minutest detail.

Answering the items in detail, the first has reference to facings; here "face and soffit measured" has been tacked on to the real clause, to render it absurd, though it is borrowed from the following item, which reads, "rough arches, face, and soffit measured." The gables and ornamental work quoted are not in this item, as a glance at the elevations would show where they are distinctly written on as terra cotta, and a price allowed for the same at the end of the bricklayer's bill, of 70*l.*, fixed complete.

The mason's bill is abbreviated. Your correspondent does not add, as the quantities state, that a tender has been received to execute the whole item fixed and cleaned down complete for 5*s.* per cubic foot, this being from a first-class mason used to my work, and after a careful study of the drawings, it being at the option of the contractor to quote lower if so disposed, or leave this item at the figure stated.

The carpenter's bill is again misquoted. All the extra labour to roof timbers has been taken separately, as would be found on a proper study of the bill, and the curved ribs to principals are taken in superficial feet in an entirely separate item, likewise the turret; and surely the dado is sufficiently described for an intelligent joiner to estimate from, especially as it is fully detailed on the drawings.

HENRY A. CHEERS.

OWNERSHIP OF DRAWINGS AND SPECIFICATIONS.

SIR,—Having lately prepared for a client sketches of a house he proposed building, he approved of the sketches and had the working drawings and specifications completed, and got estimates for carrying out the work. Expense was never named, and after the offers were got, the cost was far in excess of what he was prepared to spend, and the work was abandoned.

A charge was made for the preparing of the sketches, working drawings, and specifications, which was taken exception to, and, after some correspondence, a compromise was effected,—as it was perfectly evident that no more could be got,—thus reducing the charge to considerably below the usual percentage.

The client *now* asks for the plans and specification, three days after a discharge was given.

I shall be glad if any of your readers can inform me, through the medium of your valuable paper, (1) to whom do the sketches belong; (2) to whom do the working drawings and specification belong,—to the client or the architect? SCOTLAND.

NON-ACCEPTANCE OF LOWEST TENDER.

SIR,—In your issue of the 2nd inst. (p. 64), I read that several of the first-class builders in London are somewhat dissatisfied with the mode and matter with which their tenders are at times treated. Messrs. Rider & Son especially complain that although their tender was some 90*l.* below the next, yet they were not accepted on the grounds of the explanation given by the clients.

While sympathising to the utmost with the builders who are put to unnecessary loss of time and enormous expense, which must be the case in getting out the cost of these large jobs, yet I have often felt how the various branches of the trade which the builders have to deal with are treated, as compared to the builders themselves.

What I specially mean to call the attention of your readers, and especially of the builders themselves, to, is that when manufacturers are invited to estimate for their goods along with probably a dozen or twenty competitors in the same line of business, they very rarely have any other satisfaction than that of spending quite as much of our valuable time and incurring quite as much expense as the builders themselves do.

While admitting that the builders are probably overtaxed by letters from the manufacturers backing up their estimates and asking for the order in a variety of different ways, and likewise their representatives waiting upon them with a desire to secure the order, yet my opinion is that they have themselves to blame for thus allowing themselves to be so troubled.

There are many who issue post-cards or circular letters, thanking the manufacturers for having quoted, and regretting at not being able to accept their tenders. This, as a rule, ends the matter so far as the builder is concerned. But the manufacturer is quite as anxious to know who his competitors are, and at what prices the order has been accepted, so that they may go into the matter with a view of finding out wherein the discrepancies are; but, unfortunately for the manufacturers, the builders will neiter tell them the one thing nor the other, so that the builders themselves are on a better footing than the manufacturers; and I should just like to get this question answered by some of the builders themselves as to why they should object to send a list of the tenders to the manufacturers in the same open way in which they are dealt with by the architects. I do not go into the detail of the fairness or unfairness of your correspondents in any particular case, as I know there are architects and architects, as there are builders and builders; but we are now dealing with those builders who are worthy of the name, and not with what are termed the jerry-builders of London.

At one of the recent dinners of the Clerks' Benevolent Institution a very worthy man made a speech to the effect "that if the merchants that were present that evening would take his advice and only supply goods to the respectable builders of London, and ignore the jerry-builders, their masters (meaning the respectable builders of London) would not only make more profit, but that they, as builders' clerks, would most probably be in the receipt of higher wages," &c. This I considered a very sensible speech, and one which a merchant could but endorse; if the respectable builders of London would not encourage merchants whom we have an equal right to term jerry-merchants. R.

THE LONDON PAVILION MUSIC-HALL.

SIR,—In your description of the London Pavilion you state that the lifts are fitted by Messrs. Goddard & Co., of High-street, Peckham. This is an error, as we supplied the lifts in the Pavilion proper.

R. WAYGOOD & CO.

TIMBER MEASUREMENTS.

SIR,—In reference to the letter on this subject in your last [p. 64], the principle upon which the calculations of the sliding sale and timber measurers' tables are given appears to be as follows.

If the sectional area of a piece of square timber be 4 ft. superficial, each side will be 2 ft. across, and a cord meeting round it 8 ft. long, of which the side or parallel diameter is one-fourth, and the cord twice doubled would give the side from which to obtain the area.

It is clear that a circular piece of timber of the same diameter must have a less sectional area than the square one, from the loss of the corners. To ascertain the difference, the practical measurer assumes that a cord applied to a *circular* piece of timber will, as with a square piece when twice doubled, give the proper side (quarter-girth it is called) from which the area, and thence the cubic content, is to be derived.*

Thus, in the case in question by your correspondent, J. Wardale, the length being 15 ft. and the quarter-girth 2·25 ft., which squared gives 5·0625 ft. as the sectional area, the cubic content of the piece comes out 75·9375 ft., or, in "Hoppus," 75′ 11″ 3‴ (15′ × 5·0625′ = 75·9375 ft.).

GODALMING.

SIR,—Since writing last week, I have looked through the preface to Hoppus's "Measurer,"—one which I am told is well used,—and I find there that he published his tables partly to correct the errors of existing tables; *e.g.*, he says, "In Keay's tables this erroneous rule is given for measuring unequal-sided timber or stone: add the two sides together and take the half thereof for the true square, or take a fourth of the girt of the four sides."

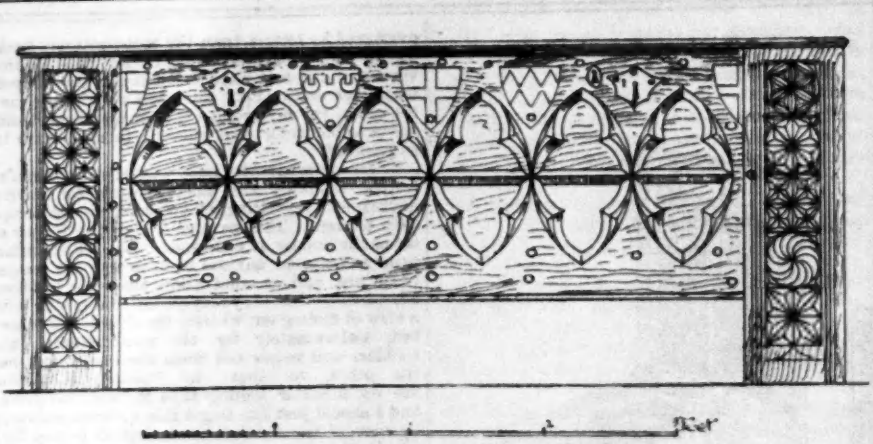
His observation on this is, "a greater fallacy could scarcely be asserted."

He is quite right.

But after this censure of Keay, one is surprised to find his own direction for measuring round timber,—"With a line gird the piece in any place, then double the line twice, and you have one-fourth of the girt for the side of the square," *i.e.*, the square which is equal to the cross section of the piece of timber.

Surely, Mr. Keay might cry out at this, "Shall the blind correct the blind?" Why, to say that one-fourth of the circumference of a circle is the side of

* Then the practical measurer is a blockhead, as so-called "practical" men often are. But see Mr. Wardale's letter following.—ED.



Ancient Chest, St. John's Church, Glastonbury.

the square, whose area is equal to that of the circle, is as great a fallacy as that of poor Mr. Keay!

In fact, he has exposed Mr. Keay's error, and fallen into as bad a one himself.

The error is a palpable one to any one possessing the smallest knowledge of mensuration.

And yet timber sellers have gone on for the last eighty years selling 100 ft. of timber as if it were 80 ft.

J. Wardale.

CHURCH-BUILDING NEWS.

York Town (Surrey).—York Town Church has just received an internal addition in the shape of a new vestry screen in carved English oak. It is in the Early English style, and has ornamental moulded panels in its lower part, whilst surmounting the transoms there are arcades of nine bays, above which is pierced tracery. A bold cornice, with pateræ in the hollows, carved in the solid, surmounts the whole. There is a door in the centre: the door furniture is of wrought iron. This screen has been designed by Mr. Arnold H. Hoole, architect, of London, and executed by Mr. Harry Hems, of Exeter.

Norwich.—From the *Norwich Argus* of the 26th ult. we learn that a new reredos of carved oak has just been erected in the well-known Church of St. Peter Mancroft, at an entire cost of nearly 1,000*l*. This reredos is of the entire width of the sanctuary (that is to say, nearly 18 ft.), and in height it is 16 ft. The work, which is Perpendicular in style, consists in the main of two series of niches, one above the other. There are nineteen of these niches on the top tier, but there are a lesser number underneath, as the two doors that lead into the eastern vestry are also incorporated in the design. The ancient doors have been retained and embraced in the new design, and with steps of polished Devonshire marble, and groined and canopied heads, now form good features. The niches are all groined, and take an ogee line. They are richly moulded and carved. The reredos has a bold cornice running from north to south, surmounted by a pierced and carved cresting. At intervals crocketed pinnacles rise above this, but otherwise it is continued across in an unbroken line. It is stated to be the intention to fill all the niches with sculpture, but at present only some of these statues are in place; others, however, are in hand. Mr. John P. Seddon, architect, of London, designed the reredos, and the carrying out of the work was entrusted to Mr. Harry Hems, of Exeter.

The Student's Column.

FOUNDATIONS.—II.

MADE GROUND.

EARTHY material that has been deposited by human hands is commonly known as "made ground." We may include under this general heading all kinds of materials that are met with above the natural virgin soil.

Town Sites of any antiquity are always covered, more or less, with the rubbish of former buildings and the refuse of houses and workshops. In the City of London the original clay and gravel are covered up with soil containing in its lowest parts remains of Roman occupation. Above this is found Mediæval and finally modern refuse, rising to a height of some 18 ft. in the oldest parts of the City. Until streets were properly paved and regularly cleansed, the hard materials thrown from the houses, together with the stone used in repairs of the roadways, were continually raising their level. It has been roughly estimated that the City has risen one foot for every century of its occupation. Ashes and charred woodwork form a large part of the material found under the houses. The upper portion of this made-ground,—that which is immediately beneath the walls of the buildings,—is generally dry and tolerably firm, having become compressed by their weight. The lower portion below the level of the sewers is wet, soft, and unsound. On the site of the Old Wallbrook, where the mud and rubbish brought down by the stream underlie the refuse of the town, it has been necessary to go down 45 ft. in order to get a firm foundation for an important building.

On the outskirts of a town all hollow places, such as old brickfields, places from which sand and gravel have been dug, and natural depressions of the soil, have been used as rubbish-shoots, and are filled up with town refuse, consisting partly of vegetable matter. In some parts of Finsbury there is a depth of 22 ft. of such ground. Refuse-heaps from mines and manufactories reach greater heights and fill up deep valleys, acquiring in time, and aided by the percolation of water, a degree of solidity according to the nature of the material.

Whether the soil in which a foundation has to be obtained is natural, or the result of such operations as have been described, it is the business of the architect to form in the first place some approximate idea of the work that will be required, having regard to the nature of his building, and to the means at his command. When the work is begun he has to watch the excavations so as to determine the depth to which it is necessary to go, and the modifications that may be required in his original ideas in order to meet the ascertained nature of the ground. The object is to get, if possible, an unyielding foundation, but, as that is seldom obtainable in the strict sense, he will be satisfied if the settlement of the ground below the building is so small as to be imperceptible. Even if the settlement is so great as to be distinctly measurable it may be of no consequence if it is uniform over the whole area of the site. Nevertheless, in towns where buildings adjoin each other, and indeed have party walls in common, it is necessary to take such measures as shall prevent any perceptible settlement, and the mischief to which it would give rise.

EXAMINATION OF THE SITE.

The first notion of the nature of the subsoil of a site will generally be gathered from those who are acquainted with the locality. A builder will have a good knowledge of the soils in his district. An excavator will have a very special knowledge of the soils in which he is accustomed to dig. It is a mistake to neglect this experience which is ready to hand. Nevertheless in cases of any importance one or more trial-holes, according to the extent of the building, or the uncertain nature of the soil, should be dug to the depth of 4 ft. or 5 ft. in ordinary cases, where no underground basement or cellar is required. Below the bottom of the trial-hole the ground may be further examined by means of an ordinary pickaxe,—still better, by a large crowbar. If it is desired to extend the examinations several feet through a doubtful soil, a long, thin, round iron rod, with a large ring handle formed on its upper end, will be found most useful. The use of such implements by one whose hand has acquired some delicacy of perception by practice will give pretty clear indication of any changes in the character of the soil as they penetrate with more or less resistance into the ground. On carefully drawing up the bar or rod, we can judge by the dirt or dust adhering to the point whether it has been in contact with such matters as brick rubbish, chalk, gravel, or clay. However valuable such examinations may be, they can only be of their full value to the person who actually makes them. To one who is accustomed to "ground work," the sensation experienced on dropping down on the feet to the bottom of a trial-hole or trench will tell whether the ground is loose, or sodden, or firm. For deeper investigations than such as can be made by hand, the apparatus used for boring will show the nature of the subsoil, foot by foot, to any required depth. If a well has to be made, and this is often necessary before deciding whether a house shall be built on a particular spot, all the information that is required may be got by that means. The natural level of the water in the ground will be ascertained at the same time, and it is important to know whether the foundation will be in tolerably dry earth or in a wet pervious soil, which will cause trouble in the excavations. But, whatever may be the nature and the extent of such preliminary trials, it is well, especially in the made ground of a town site, to be prepared for the contingency of a worse soil being found than these partial examinations indicate. The provision in a contract of as much additional excavation and concrete as can reasonably be thought prudent, will prevent the embarrassment which would otherwise be felt on the sudden discovery of unsatisfactory soil when the excavations are being made.

SOILS THAT ARE BAD AS FOUNDATIONS.

We have seen that such subsoils as rock and compact gravel form the best natural foundation, requiring only to be properly levelled to receive the footings of a wall. All other subsoils may be considered unsatisfactory in a greater or less degree. In respect of their defects they may be classed as follows:—

1. *Soils that are simply compressed* by a heavy load becoming firm when the full load has been put upon them. Made ground that has not become thoroughly consolidated generally yields in this way, particularly if the materials of which it is composed are soft or loosely packed or full of water that is driven out by pressure. The top soil of all ordinary sites will also yield in this way owing to the disturbing operations to which it has been subjected; but, as a rule, the virgin soil, deposited by water in its present position, does not compress very materially.

2. *Soils that squeeze out* under a load, escaping like a paste or thick fluid. Clay,—besides its liability to swell with moisture and to contract from dryness,—will squeeze out in this way when it is wet. When the wall of an ordinary building has its footings deep in compact clay unaffected by water no mischief may result, but if the clay becomes wet it will be forced aside from the part immediately under the wall and the projecting footways will be broken or tilted up, so as to become useless for their purpose. A soil that consists of wet silt or mud may be so soft as to be incapable of bearing a wall, which will, therefore, sink, while the soil which it displaces is forced up so as to raise the surface of the ground adjacent to it.

3. *Soils of irregular composition* along the course of the same wall. Where the natural soil suddenly changes, owing to beds of different materials cropping up to the surface where a site extends from higher ground down to the margin of a stream, and where the ordinary variations of made ground exist, this kind of foundation has to be dealt with. Upon an old building site such irregularities have to be specially apprehended.

Manchester Architectural Association. The last general meeting of this Association was held on the 5th inst. at the Diocesan Buildings, Mr. L. Booth (President) in the chair. Mr. J. Spencer Hodgson (Vice-President) read a paper on "Architectural Ethnography," to which we may return. A discussion followed, in which Messrs. Mee, Talbot, and the chairman took part.

Books.

Architecture, especially in Relation to our Parish Churches. By the REV. H. H. BISHOP, M.A. London: Society for Promoting Christian Knowledge.

IF the illustrations were equal to the text this would be a very good book, for it is well written and shows something more than a superficial acquaintance with the subject. But the woodcuts have not been made for the work, and consequently do not fit it. Many of them are of very indifferent quality indeed. We renew a long-severed acquaintance with many of Birket Foster's charming drawings, and have nothing but admiration for them as pictures, worn to death as many of them evidently are. But as elucidations of our native ecclesiastical art they are of but little value. Indeed, the pictorial side of that art has been kept almost exclusively in view: there is not a single plan, nor any deliberate effort to deal with the interior arrangements of our parish churches, and the changes which they have undergone to adapt them to a changing ritual. The (probably) Roman Church at Brixworth is described, but not illustrated, nor is the well-known church of St. Martin at Canterbury, nor the more remarkable church in Dover Castle, while many of the very numerous illustrations illustrate nothing in particular. This is annoying, because the book deserves a few specially-prepared drawings, and a few would make what is now, at least, obscure to the general reader, fairly intelligible. A table of the names of the several periods and their dates should be added, and a glossary would be an improvement. The author has evidently imbued himself with the spirit of Ruskin, as the following extract *apropos* of thirteenth-century work will show. "It speaks clearly of work done by one who rejoiced in it, and delighted to see that it was good. And since the creation of the world no noble work has ever been done otherwise, or ever can be." And the following, whether original or not, shows the writer to have a firm grasp of the essentials of Gothic architecture. "Look at such a doorway as that of Adel Church, Yorkshire. How rude and irregular in its workmanship! You may find that no two points of its zig-zags are exactly of the same angle or of the same projection. Each is roughly worked out of its own separate stone, and takes its chance of being equal to the others. And as the stones happen to be of unequal width, so are the ornamental points upon them. This is why our modern attempts at Norman have failed; the mason of the present day feels he '*cannot make it bad enough*,' and it becomes ridiculous when measured out with modern compasses and worked to smoothness by modern tools." The above and similar passages show an insight not met with generally in popular works on art. The popular element in the book is perhaps its least satisfactory feature, and the various dissertations on the beauty and superiority of a particular phase of religious faith, and the implied shortcomings of other creeds, might have been omitted.

The enormous number of churches referred to in the course of the work,—many of them apparently personally examined by the author,—is surprising; and, in so far as we are able to test it, so is the general accuracy of his multitudinous descriptions. We are disposed to think that the dog-tooth ornament was elaborated from the earlier "nail-head," and not from the "fining down and undercutting of the Norman zig-zag, where the zig-zag points meet upon an edge"; but that is a detail.

On the whole, we are very favourably impressed with this little work; but we should like to see the mass of information which it contains as to the idiosyncrasies of our numerous parish churches systematised, and the over-worn woodcuts give place to some suitably-chosen and architecturally-drawn illustrations.

Easements and Rights of Light. By JOHN HOLDEN, F.R.I.B.A., F.S.I. Manchester. 1885.

THIS is the reprint of a paper read before the Manchester Architectural Society. It can scarcely be considered as an essay, it is simply a collection of some of the cases concerning the right to light with a few comments, and shortened and analysed. So far as it goes the paper is well done, and may be of some use to architectural students who desire to form an idea of some of the leading cases in regard to the right to light. It has, however, this drawback,—it has not the completeness of a regular legal collection of judicial decisions, nor the literary and professional interest of an essay on the easement of light. Nor are the cases classed under one particular head, or arranged in chronological order. The references also are extraordinarily erratic, being the first one and then another set of legal reports without any rule. The most that can be said of this paper is that such cases as are printed are accurately analysed.

The Queen Eleanor Memorial, Waltham Cross, with Historical Notices of "Ye olde Foure Swannes Hostelerie, A.D. 1260," and other Places of Interest in Cheshunt. By WILLIAM WINTERS, F.R. Hist. S. (Churchyard, Waltham Abbey).

As the season advances, we would strongly recommend those of our readers who want an object for their walk or ride to pay a visit to Cheshunt, and, under Mr. Winters's able guidance, inspect the beautiful Eleanor Cross (restored by Mr. C. E. Ponting), the Four Swans Inn (formerly the Manor House), and Waltham Abbey, with its numerous points of interest. Mr. Winters deserves much credit for the unsparing diligence with which his researches have been prosecuted, as well as for their happy result.

Uber Antike Steinmetzzeichen. Fünf-und-vierzigstes Programm zum Winckelsmanns Feste der Archäologischen Gesellschaft zu Berlin von OTTO RICHTER, *mit drei afeln.* Berlin: Rurner. 1885.

DR. OTTO RICHTER does good service to the history, and more especially to the exact chronology of ancient architecture by his monograph on the "stonemasons' marks" of antiquity. The subject of these marks has, as regards classical masonry, received as yet far too little attention. Isolated instances have, indeed, been noted. More than fifty years ago Mazois, in his "Ruines de Pompei," published a series of Pompeian stonemasons' marks, and since then, from time to time, attention has been called to the marks on the masonry discovered at Samothrace, on the foundations of the Cæsereum at Alexandria, and especially to those on the Severian and Palatine walls at Rome. The recent discoveries by the Prussians at Pergamos and by Dr Schliemann at Troy have brought to light new "marks." A systematic treatment of these marks was much needed, and this want Dr. Richter supplies. He gives us an introductory chapter on the geographical distribution of these "stonemasons' marks"; then a detailed account of the marks found at Rome, Pompeii, Perugia, and Eryx; and, finally, a chapter on the origin and significance of these marks. Three beautiful lithographed plates give *facsimiles* of the marks *in situ* on the masonry, and some isolated instances. The monograph appears on the fifty-fourth "Programm" of the Winckelmann anniversary at Berlin.

RECENT PATENTS.

ABSTRACTS OF SPECIFICATIONS.

5,542, Slate-grinding Machine. G. Walker.

Working across the surface of a horizontal revolving table are two chains or sheets, one on each side of the centre line, and running over the chain wheels, whose spindles are carried in girders extending across the revolving table, and resting at their ends on a fixed platform. Loose rollers are provided for the purpose of giving additional pressure to the slates. There is also a trough for collecting the spent sand and water. The slates are passed on one after another between the chain and the revolving table, and are carried forward by contact with the former, the grinding being effected by sand and water. After having passed across the table once the slates are placed under the other chain, which runs in the opposite direction, and traverse the table a second time.

11,308, Railway and other Carriages. W. Wainwright.

Carriage bodies as usually constructed harbour dirt, and require frequent painting. The present invention is designed to obviate this. Panels secured to the framework of the body inside and outside the carriage are made of sheet metal, and coated externally with a surface of nickel or silver. The borders of the panels may be provided with metallic beads or mouldings. The door-pillars and frames may also be made of metal coated if desired. An additional advantage is obtained by the better diffusion of light from the bright surfaces in the interior of the carriage.

12,046, Setting off Angles and Distances. J. Hermann.

This instrument is used for setting off points whose relative positions have to be obtained very accurately. The work is clamped to a platform on a wheel divided into 360 teeth, carrying a collar divided into 360 teeth, and clamped to the wheel as required. The toothed wheel is free to turn on an arbor fixed to a platform attached to a V-slide so as to be capable of rectilinear motion, the extent of which is indicated on a scale. Some point is chosen as origin, and the work is then clamped, so that the centre spindle comes exactly over this point. Zero being shown on the various scales. By advancing the V-slide, and turning the toothed wheel according to the given co-ordinates of the points to be obtained, the work is moved into positions for the points to be marked by the centreing spindle.

13,457, Staircase Treads, &c. J. Whitely.

Plastic indiarubber is placed in the perforations of a metal grating, and fixed in its place by vulcanising. It is generally most convenient to place two gratings one over the other, fill the interstices as described, and then remove the upper grating, which produces a mat or a tread suitable for stairs, halls, passages, &c.

NEW APPLICATIONS FOR PATENTS.

Dec. 24.—15,847, D. Howell, Improvement in Casement Window-stay.—15,856, J. S. Thompson and W. Thompson, Improvements in Slate or Glass Roofing.—15,860, H. Doulton, Improvements relating to the Joints of Stoneware Pipes.—15,868, F. Candy and N. Frere, Improved Closet Pan Disinfectant.—15,870, W. Lea, Improved Hot-air Heating and Ventilating Stove.—15,877, J. Dejaiffe, Process and Apparatus for Dressing, Polishing, and Squaring Stone, &c.—15,880, E. Palmer, Improvements in Open Trough Water-closets and Urinals.

Dec. 28.—15,931, R. White, Improved Vacuum Blower for Stoves.—15,937, H. Ker, Improvements in the Preparation of Timber for Flooring and Match-boarding.

Dec. 29.—15,975, P. Nisbet, Improvements in Hand-boring or Drilling Tools for use in Quarries, &c.—15,997, E. Laporte, Ornamentation of Varnished Surfaces.

Dec. 30.—16,012, J. Kenjon and J. Conlong, Improvements in Water-closets.

Dec. 31.—16,065, G. Bishop, Improved Firebricks, &c.—16,069, J. Corry, Improved False Grate for Kitchen and other Domestic Fire-grates.—16,076, B. Finch, Improved Sanitary Pipes and Joints for same.—16,080, E. Johnson, Open Grates and Stoves for Saving Fuel and Consuming Smoke.—16,090, J. Hunt, Improvements in the Method of Producing Wall-coverings, Roofing, &c.—16,096, H. Haddan, Improvements in the Construction of Terraces and Flat Roofs.

PROVISIONAL SPECIFICATIONS ACCEPTED.

13,757, C. Hollingdrake and W. Stanfield, Improvements in Hot-water Apparatus for Domestic and similar purposes.—14,794, R. Anderson, Apparatus for Ascending Chimneys, &c.—15,031, W. Collis, Jointing Cast-iron or other Rain or other Water Gutters.—17,070, T. Ray, Method of Fixing Hollow Metal Bars, &c., in Ladders, Gratings, &c.—13,247, H. Headland, Improved Pot for Preventing Down-draught.—13,595, A. Brookes, Improvements in the Manufacture of Artificial Stones or Marbles.—13,741, D. Baker, Improved System and Construction of Ventilating Flues.—13,841, H. Ashley, Improvements in Cooking Stoves.—13,921, W. Ryan, Soldering Iron.—14,222, J. Taylor, Improvements in Saw Spindles.—14,253, C. Garlick, Improvements in the Construction of Stench-traps for Drains.—14,321, W. Hucklebridge, System of Glass Roofing.—14,457, E. Verity and Others, Improved Pivot and Weather-bar Arrangement for Swing and Reversible Windows, Doors, &c.—14,584, E. Wright, Improvements in Saws.—14,743, A. Howell, Sash Fastener.—14,760, G. Haydon, Escutcheons for the Keyholes of Street-door and other Locks.—14,825, E. Brennan, Improvements in Window-sash Fasteners.—15,214, J. Hancock, Ornamenting Surfaces in Imitation of Inlaid Woods.

COMPLETE SPECIFICATIONS ACCEPTED.

Open to opposition for two months.

1,778, J. Tomlinson, Improvements in the Manufacture of Plaster or Cement.—1,862, J. Wilesmith, jun., Securing Door, Cupboard Knobs, &c., to their Spindles.—2,775, W. Donald, Manufacture of Refractory Materials, Bricks, &c.—5,188, A. Lake, Illuminating Combination Tiles.—13,208, E. Dredge, Improved Apparatus for Cutting Wood, &c.—14,518, J. Ward, Improvements in the Manufacture of Artificial Rock-work and Ground.—14,545, A. Bean, Improvements in Water-closets.—2,469, J. Calton and W. Eglin, Folding Seats and Tables.—2,751, S. Hurst, Sash Fasteners.—2 956, E. Collier, Attaching Knobs to Spindles.—3,488, G. Stephens, Improved Process for Ornamenting Glass.—4,014, F. Wildegose, Stop or Bolt for preventing the further opening of Windows, Shutters, Sliding Doors, &c., when partially open.—13,699, W. Keller, Improvements in the Manufacture of Cement or Mortar.—13,958, Improvements in Kitchen or Room Fire Grates.—14,353, J. Peckover, Improvements in Stone Sawing Machines.—14,734, J. Marples, Improvements in Marking, Cutting, and Mortise Gauges.

MEETINGS.

FRIDAY, JANUARY 8.

University College.—Professor Newton, C.B., on "Greek Inscriptions." 4 p.m.——Professor Charles Graham on "Chemistry in its Relation to Engineering and Architecture." 8 p.m.

MONDAY, JANUARY 11.

Royal Academy of Arts.—Mr. J. E. Hodgson, R.A., on "Art in England." I. 8 p.m.

Surveyors' Institution.—Discussion on Mr. Wells's paper on "Farm Crops." 8 p.m.

Inventors' Institute.—8 p.m.

Leeds and Yorkshire Architectural Society.—Mr. W. M. Fawcett, F.S.A., on "Points in the History of Collegiate Buildings."

TUESDAY, JANUARY 12.

Institution of Civil Engineers.—Mr. F. J. Rowan on "Gas-Producers." 8 p.m.

Society of Biblical Archæology.—Anniversary meeting. 8 p.m.

WEDNESDAY, JANUARY 13.

Society of Arts.—Mr. W. H. Ablett on "Museums for Trade Patterns." 8 p.m.

Civil and Mechanical Engineers' Society.—General meeting. 7 p.m.

Liverpool Engineering Society.—Mr. A. J. Maginnis on "A Strange Failure of Steel Boilers." 8 p.m.

Institution of Civil Engineers of Ireland (Dublin).—Mr. James Otway on "The Port and Harbour of Waterford." 8 p.m.

THURSDAY, JANUARY 14.

Royal Academy of Arts.—Mr. J. E. Hodgson, R.A., on "Art in England." II. 8 p.m.

Society of Antiquaries.—4.30 p.m.

FRIDAY, JANUARY 15.

Architectural Association.—Mr. Lewis F. Day on "Stained Glass." 7.30 p.m.

Society of Medical Officers of Health.—Dr. Swete on "The Suction of Sewer-gas into the Water-supply, a fertile Cause of Enteric Fever." 8 p.m.

Institution of Civil Engineers (Students' Meeting).—Mr. R. E. von Lengerke on "The Graphic Method of Determining the Flow of Water in Pipes." 7.30 p.m.

Miscellanea.

Associated Carpenters and Joiners of Scotland.—During the present week a conference of delegates connected with the Associated Carpenters and Joiners of Scotland has been held in Glasgow. The delegates, who number over a dozen, were gathered from centres as widely apart as the north of Scotland and the south of England. In the United Kingdom there are 101 branches of the Society, 91 being in Scotland, nine in England, and one in Ireland. The membership on the rolls at the end of the past year showed an aggregate of 4,534. During that period the income amounted to 6,088*l.* 12s. 11d., and the expenditure to 6,266*l.* 15s. 10d. In spite of the demand thus made upon the funds, the assets still ran up to 8,720*l.* 12s. 2d. The conference has had in view the revision of the rules, and this involves some important matters, such as the vexed question of out-of-work benefit. On the occasion of the preceding conference, held six years ago, when, as now, trade was greatly depressed, the vote against the scheme was decisive, being almost two to one.

Inland Navigation in Siberia. — M. Sibiriakoff, the enterprising St. Petersburg merchant, who, in conjunction with Professor Nordenskjöld, had for several years past been making efforts to open a shipping trade with the coasts of Asia on the Arctic Ocean, has at length been compelled to abandon the project in its original form. The experiences of the last two seasons have induced him to substitute, in place of the sea route, another method of reaching the chief rivers of Siberia. He has projected a canal, which is now under construction, with a view to connect the two rivers Obi and Yenissei, whilst other preparations on an extensive scale are proceeding upon the Angara, in order to render navigation practicable from the two stations on Lake Baikal and the Yenissei. If these plans can be carried out, they will enable various kinds of produce to be conveyed by water throughout Siberia, the Lena being already in communication with Lake Baikal. Thus, the total distance which it will be necessary to traverse by land between St. Petersburg and the Obi will only be 170 versts, or 112 miles. It may be added that in connexion with this new commercial route preparations have already been made for the cutting of a road from Petchora right across the Ural Mountains to the river Obi.

Greek Archæology.—At University College, London, Professor Newton will deliver in the Second Term a course of three lectures on Greek inscriptions, followed by three on Greek Myths illustrated by Fictile Vases and other Monuments. The dates of the lectures are Jan. 8th, Jan. 22nd, Feb. 5th, Feb. 19th, March 5th, and March 19th.

Water Supply of Walton-le-Dale, near Preston, Lancashire. — At the monthly meeting of the Walton-le-Dale Local Board, held on Monday last, the 4th inst., a report upon the progress of the new works of water supply was presented by the engineer, Mr. William Wrennall, of Liverpool. From it we learn that the branch heading, which was yielding water at the face, has been continued during the past month; and the work all through has proved to be very successful in procuring water. This heading has now been cut to a length of 105 ft. from the main heading, the last 68 ft. having been driven during the past month. The cutting is in a direction parallel to the large fault which crosses the main heading, and follows close to it all the way. The rock roof of the cutting terminates at the fault, and as the dip of the strata is towards the fault, the heading is in the favourable position to receive, as it is continued, all the water which the rock contains. The strata has been mostly wet, and in places some large streams of water have been tapped, which have added very considerably to the total yield. The quantity pumped at the present time is about 190,000 gallons per day, as against 145,000 gallons per day reported last month. There is also every probability, from the knowledge now acquired of the favourable position of the present cutting, that further water may be procured as the heading is continued to be extended. The total length of headings cut up to the present time is 220 yards. We are informed that the Local Board constructed works of water-supply to their district some four years ago. The pumping station is situated in the adjoining township of Brindle. A well, 8 ft. in diameter, was sunk to a depth of 110 ft., and a bore-hole was continued from the bottom of it down to a total depth of 537 ft. from the surface. The yield from these two sources was, however, found to be considerably less than had been anticipated, and after some two or three years' pumping the supply proved to be quite inadequate for the then requirements of the district, and especially during the late dry seasons. Under these circumstances, the Board some twelve months ago called in Mr. Wrennall, to advise them in the matter, and under his direction the works are now being carried out.

Works on Mediæval Costume, &c.—Mr. Bernard Quaritch, of Piccadilly, sends us a list of works on Mediæval costume, illuminated ornaments, antique alphabets, furniture, ancient arms and armour, and architecture, by Messrs. Henry Shaw, F.S.A., Joseph Strutt, J. R. Planché, Sir S. R. Meyrick, and other writers. The list will repay examination.

Iron, Hardware, and Metal Trades' Pension Society.—The thirtieth annual ball of the Iron, Hardware, and Metal Trades' Pension Society will take place at Willis's Rooms, early in February, under the presidency of Mr. Jonathan Pearson, a member of the firm of R. H. & J. Pearson, of London.

Royal School of Mines.—Prof. Warington Smyth, F.R.S., in resuming his lectures upon mining in the Lecture Theatre of the Geological Museum, Jermyn-street, commented upon the importance of a thorough knowledge of geology in all cases where the discovery of mineral is the object in view. Practical knowledge holds good only so far as certain districts are concerned, and if such knowledge only is brought to bear upon other localities, very grievous mistakes, and consequent waste of capital, are always likely to ensue; indeed, it would be easy to point to recent cases where the prejudice of miners in this respect has led to such results. The only means to obviate possibilities of this kind is to familiarise ourselves with the recognised laws laid down by geologists, and to study the various conditions under which deposits are met with in the field. In cases where coal is the object of search, the miner too frequently presumes that a certain district will produce coal because the soil consists of a coaly clay, or because limestone and sandstone exist in the immediate neighbourhood, or because the wells and springs deposit a quantity of ferruginous matter. These appearances all accompany the occurrence of coal, but not always. The evolution of carburetted hydrogen or fire-damp from the surface of the ground often leads to unfortunate conclusions. Such evolution occurs in large volumes sometimes, so that it affords artificial light or heat, as in the case of the fire-wells in China, and again in Hungary, where the main galleries in some of the mines are lighted by the carburetted hydrogen so derived. But cases are not infrequent where the evolution of this gas does not proceed directly from coal, as from some of the later formations in which the Americans have sunk bore-holes and wells for the purpose of extracting petroleum. Again, in the case of salt, where the occurrence of salt springs is supposed to indicate the presence of salt; but this is not true, as in sinking through the sandstone of the coal-measures, the water is found to be notably salt. A knowledge of the geology of the subject may often meet all these objections in so far as it affords the necessary information requisite for a clear conception of the origin of phenomena which may exist under certain conditions, but which are not exclusively confined to such.

A Remarkable Factory Chimney.—The Mechernich Lead Works, near Cologne, have now a chimney of the following dimensions:—

	Ft.	In.
Depth of foundations	11	6
Length of each of the four sides of ditto	36	1
Height of basement	32	10
External diameter at base	24	7
External diameter at top	11	6
Internal diameter	9	10
Height of column alone (of round form)	397	4
Total height	441	7

This chimney occupied rather more than a year in construction.

Hull.—An orphan asylum at Hull is now almost completed, the architects for the work being Messrs. Smith & Brodrick, of Hull. Wood block flooring is being laid by Messrs. Geary & Walker, of Manchester, on their patent system.

Partnership.—Mr. Sidney Young and Mr. W. B. Brown, who have for several years occupied joint offices at No. 5, Henrietta-street, Covent-garden, have recently entered into partnership.

The Surveyors' Institution. — The Students' Preliminary Examination, 1886, will be held at the Institution on the 19th and 20th of January, commencing at ten o'clock each day.

Newcastle-on-Tyne. — A new Wesleyan Chapel has recently been opened at Byker. It has been built as a substitute for an older chapel in Shields-road, Byker, which has proved too small, and, like it, will be known as the "Bainbridge Memorial." The new chapel has sittings for 900 adults, capable of being increased upon occasion to upwards of 1,000. There is a lecture-hall adjoining, which will accommodate from 300 to 350 persons, and there are five vestries or class-rooms allocated to various purposes, also a ladies' cloak-room, lavatory, &c. In plan the chapel consists of a nave with side aisles and shallow transepts, the extreme internal dimensions being 98 ft. by 55 ft. 6 in. by 40 ft. high. There are galleries all round the interior, that for the choir and organ being behind the platform in an apsidal recess. The edifice is built of stone in the Early English style of Gothic architecture, and has a handsome tower at the north-east angle rising to a height of 90 ft. from the ground. The internal fittings are of pitch-pine. The general contractors are Messrs. Greason & Stockdale, of Gateshead, who executed the carpenters' and joiners' work, and entrusted the masons' work to Mr. T. H. Hutchinson, and the ironwork to Messrs. Bainbridge & Crimson, also of Gateshead; the lead glaziers' work to the Gateshead Stained Glass Company; the slating to Mr. John Hewitson; the plastering to Mr. Thomas Wallis; the plumbing to Mr. R. Herron; and the ordinary glazing, painting, and varnishing to Messrs. A. Robertson & Son,—all of Newcastle. The gas-fittings have been supplied by Messrs. T. Thomason & Co., of Manchester; the lecture-hall seats by the North of England School Furnishing Company; the lightning conductor by Messrs. Henry Walker & Son, of Newcastle; and the warming and ventilating apparatus by Messrs. Dinning & Cooke, of Newcastle. The buildings are warmed by hot water on the low-pressure system, arrangements being made for the admission of fresh air warmed by passing over coils of pipes, while the tower is utilised for ventilation, and forms a powerful extracting-shaft for the vitiated air, tests by the anemometer showing that the air inside the chapel is changed three times an hour. The clerk of works is Mr. James Grant, and the architects are Messrs. S. Oswald & Son, of Newcastle, whose designs were selected in competition, and under whose personal supervision the whole of the works have been carried out, the total cost, including site, being about 6,300*l.*

An Old Publishing House.—On Saturday afternoon a party of guests inspected the new building which has been erected at the corner of St. Paul's Churchyard and Ludgate-hill, for Messrs. Griffith, Farran, & Co., successors to John Newbery, who published the "Vicar of Wakefield" for Oliver Goldsmith, the house being known in those days as "The Bible and Sun." Messrs. Kirk & Randall, the builders, have reared the new structure from the designs of Messrs. Carritt & Monier Williams, in less than six months from the time of the pulling down of the old fabric. The exterior is faced on the ground and first floors with red Mansfield stone, and polished granite pilasters, and the superstructure with white Portland, the whole being surmounted by a carving in stone of the old sign of the house of John Newbery, "The Bible and Sun," with the motto "Fiat lux." On the capitals of the pilasters of the ground-floor are carved on stone medallions heads of John Newbery, Oliver Goldsmith, Dr. Johnson, and Bewick, the latter being the father of modern wood engraving, who embellished many of the books issued by the house at the end of the last and the beginning of the present century. The interior fittings are of oak throughout. A handsome staircase, with a dado of Giallo Antico marble, from the ancient quarries of Numidia, with a capping of ancient Fio di Persico, as found in the ruins of Rome, leads from the retail shop to a showroom and book saloon on the first-floor, both lighted by the new Cromartie lamp. In excavating the basements, says the *Daily Chronicle*, traces of a road of chalk formation were found at about 6 ft. or 7 ft. below the pavement, and at a considerably greater depth were the remains of an old causeway, with a foundation which had the appearance of having been constructed of reeds. It was only after digging down a distance of 25 ft. from the pavement that a solid bed of gravel was found on which to erect the iron stanchions which carry the weight of the building.

PRICES CURRENT OF MATERIALS.

TIMBER.	£.	s.	d.	£.	s.	d.
Greenheart, B.G. ....ton	6	10	0	7	10	0
Teak, E.I. ....load	12	10	0	15	10	0
Sequoia, U.S. ....ft. cube	0	2	6	0	3	9
Ash, Canada ....load	3	0	0	5	0	0
Birch ,, ...	3	0	0	4	10	0
Elm ,, ...	3	10	0	5	0	0
Fir, Dantsic, &c.	1	10	0	4	10	0
Oak ,, ...	3	0	0	5	0	0
Canada	6	0	0	7	0	0
Pine, Canada red	3	0	0	4	0	0
,, yellow	3	15	0	5	5	0
Lath, Dantsic ....fathom	4	10	0	6	0	0
St. Petersburg	5	0	0	7	0	0
Wainscot, Riga....log	2	15	0	4	10	0
,, Odessa	3	12	6	3	15	0
Deals, Finland, 2nd and 1st...std. 100	7	10	0	8	10	0
,, 4th and 3rd	6	0	0	7	10	0

TIMBER (*continued*).	£.	s.	d.	£.	s.	d.
Riga	6	0	0	8	0	0
St. Petersburg, 1st yel.	9	0	0	15	0	0
,, 2nd ,, ...	7	0	0	8	15	0
,, white	8	0	0	10	10	0
Swedish	6	0	0	15	10	0
White Sea	8	0	0	18	0	0
Canada, Pine 1st	17	0	0	31	10	0
,, 2nd	12	0	0	17	10	0
,, 3rd, &c.	7	0	0	10	0	0
,, Spruce 1st	9	0	0	12	0	0
,, 3rd and 2nd	6	0	0	8	0	0
New Brunswick, &c.	5	0	0	7	0	0
Battens, all kinds	4	0	0	12	0	0
Flooring Boards, sq. 1 in.—Prepared, first	0	9	0	0	13	0
Second	0	7	6	0	8	6
Other qualities	0	5	0	0	7	0
Cedar, Cuba....foot	0	0	3½	0	0	4
Honduras, &c.	0	0	3	0	0	4
Australian	0	0	3	0	0	3½
Mahogany, Cuba	0	0	5	0	0	7½
St. Domingo cargo av.	0	0	5½	0	0	7½
Mexican ,, ...	0	0	4	0	0	5
Tobasco cargo av.	0	0	4	0	0	6½
Honduras cargo av.	0	0	4½	0	0	6½
Maple, Bird'seye	0	0	3½	0	0	6
Rose, Rio ....ton	7	0	0	16	0	0
Bahia	6	0	0	14	0	0
Box, Turkey	5	0	0	18	0	0
Satin, St. Domingo ....ft.	0	0	0	0	0	0
Porto Rico	0	0	0	0	0	0
Walnut, Italian	0	0	4	0	0	5

METALS.						
IRON—Pig in Scotland ....ton	2	2	6	0	0	0
Bar, Welsh, in London....	4	15	0	5	0	0
,, ,, in Wales	4	7	6	4	10	0
,, Staffordshire, London	5	15	0	7	0	0
Sheets, single, in London....	7	10	0	9	0	0
Hoops ,, ...	6	5	0	7	5	0
Nail-rods ,, ...	5	15	0	7	0	0
COPPER—						
British, cks. and ingt. ....ton	43	10	0	44	10	0
Best selected	45	0	0	46	0	0
Sheets, strong....	52	0	0	0	0	0
,, India	48	0	0	48	10	0
Australian, fine cash....	0	0	0	0	0	0
Chili, bars ,, ...	40	12	6	41	0	0
YELLOW METAL....lb.	0	0	4½	0	0	4½
LEAD—Pig, Spanish	0	0	0	0	0	0
English, com. brands	0	0	0	0	0	0
Sheet, English	12	15	0	0	0	0
SPELTER—						
Silesian, special ....ton	0	0	0	0	0	0
Ordinary brands	0	0	0	0	0	0
TIN—						
Banca	96	0	0	0	0	0
Billiton	94	0	0	0	0	0
Straits	93	10	0	93	0	0
Australian	93	10	0	93	0	0
English ingots....	97	0	0	0	0	0
ZINC—						
English sheet	0	0	0	0	0	0

OILS.						
Linseed ....ton	19	10	0	19	17	6
Cocoanut, Cochin	29	10	0	30	0	0
Ceylon	26	0	0	0	0	0
Copra....	14	10	0	16	5	0
Palm, Lagos	29	10	0	0	0	0
Palm-nut Kernel	25	0	0	25	10	0
Rapeseed, English pale....	23	0	0	0	0	0
,, brown	21	10	0	21	15	0
Cottonseed, refined	17	10	0	19	0	0
Tallow and Oleine	25	0	0	40	0	0
Lubricating, U.S.	7	0	0	10	0	0
,, Refined	4	0	0	12	0	0
TURPENTINE—						
American, in cks. ....cwt.	1	6	9	1	7	0
TAR—Stockholm ....brl.	0	19	0	0	19	6
Archangel....	0	12	0	0	13	6

COMPETITIONS AND CONTRACTS.

Epitome of Advertisements in this Number.

COMPETITIONS.

Nature of Work.	By whom required.	Premium.	Designs to be delivered.	Page.
New Wing to Buildings	East London Hospital...	Not stated	March 1st	i.

CONTRACTS.

Nature of Work, or Materials.	By whom required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.	Page.
Brick Sewer	Tottenham Local Board	— De Pape	Jan. 12th	ii.
Alterations at Synagogue, Bishopsgate		L. Reed	do.	xviii.
Kerbing, Tar-paving, &c.	Lewisham Board of Wks	*Official*	do.	ii.
Removal of Dust, Dirt, &c.	Crown Estate Com....	do.	Jan. 13th	i.
Rebuilding Class-Rooms	Anglo-French College...	B. Fletcher	do.	ii.
Play-room and Repairs to School	Guardians of St. Mary, Islington....	W. Smith	Jan. 14th	ii.
Erection of Urinals	Fulham Board of Wks.	*Official*	do.	ii.
Wood Paving	do.	do.	do.	ii.
Main Drainage Works	Finchley Local Board...	G. W. Brumell....	Jan. 15th	ii.
New Pavilion	Derby Castle Co. (Lim.) Isle of Man	W. J. Rennison	Jan. 18th	ii.
Flints, Kerb, and Tar Paving	Kingston-on-Thms Cor.	*Official*	do.	xviii.
Water Vans and Carts	St. Mary, Islington ...	do,	Jan. 19th	xviii.
Street Watering-Posts, &c....	do.	do.	do.	xviii.
Making-up Carriageways, &c.	Vestry of Rotherhithe	E. Thomas	do.	xviii.
Works and Materials	Wandsworth Bd. of Wks	*Official*	do.	ii.
Paving Works....	Greenwich Brd. of Wks	do.	Jan. 20th	ii.
Wharf, New Dock Wall and Sewage Works...	Plymouth U.S.A....	G. D. Bellamy	Jan. 23rd	ii.
Construction of Tunnel	Leeds Cor. Waterworks	Filliter & Rofe	Jan. 26th	ii.
Painting Station at York	North Eastern Railway	H. Copperthwaite	Jan. 27th	ii.
Extension of School, &c.	Met. Asylums Board ...	A. & C. Harston	Jan. 29th	ii.
New Lunatic Asylum	Derby Corporation	B. S. Jacobs	Jan. 30th	ii.
Watering and Cleansing	Com. of H.M. Works...	*Official*	Feb. 1st	i.
Boundary-Walls, Abutments, &c., for Bridge	Colne and Marsden L. B.	H. Bancroft	Feb. 2nd	ii.
Ironwork for Bridge....	do.	do.	do.	ii.

TENDERS.

BETHNAL-GREEN.—For enlargement of schools, New Castle-street, Bethnal-green, for the School Board for London. Mr. T. J. Bailey, architect:—

F. Sargeant	£9,967	0	0
F. & F. J. Wood	9,769	0	0
Scrivener & Co.	9,730	0	0
Godfrey & Son	9,689	0	0
Stephenson	9,583	0	0
J. Grover & Son....	9,550	0	0
Wall Bros.	9,300	0	0
C. Wall	9,125	0	0
Patman & Fotheringham	9,100	0	0
M. Gentry	9,062	0	0
T. Oldrey	8,998	0	0
Kirk & Randall	8,975	0	0
Lathey Bros.	8,936	0	0
W. Shurmur	8,883	0	0
C. Cox	8,878	0	0
J. Holloway	8,850	0	0
Atherton & Latta....	8,800	0	0
E. C. Howell & Son....	8,777	0	0
W. Downs	8,767	0	0
H. Hart	8,740	0	0
Stimpson & Co....	8,653	0	0
Priestley & Gurney	8,602	0	0
S. J. Jerrard	8,573	0	0
J. R. Hunt....	8,566	0	0
W. Johnson	8,400	0	0

BETHNAL-GREEN.—For erection of four shops, Bethnal Green-road. Messrs. Hovenden, Heath, & Berridge, architects:—

Higgs	£3,820	0	0
S. Pritchard	3,760	0	0
W. Shurmur	3,690	0	0
Scrivener & Co....	3,684	0	0

BURGESS HILL (Sussex).—For the erection of a dwelling-house in the Junction-road, for Miss Pierson. Mr. E. J. Hamilton, architect, Brighton:—

J. Barnes, Brighton	£535	0	0
W. Bryant, Burgess-hill	485	0	0
Cox & Sons, Brighton	481	16	4
S. Norman, Burgess-hill	469	0	0
W. Oram, Burgess-hill	444	0	0
W. Downer, Burgess-hill (accepted)...	394	0	0

CHRISTCHURCH (Hants).—For making new roads on the "Walkford Glen Estate," near Milton, for the South Coast Freehold Land Society. Messrs. Kemp, Welch, & Pinder, surveyors:—

G. Strickland	£345	15	6
S. White....	182	10	0
R. W. Watton	162	0	0
G. Troke (accepted)....	135	0	0

Fencing.

E. Wellman accepted at 9½d. per yard.

FAVERSHAM.—For an addition to the Women's Hospital at the Faversham Union. Mr. B. Adkins, architect, Faversham. Quantities supplied:—

G. Dawson....	£998	0	0
Denne & Son....	994	0	0
Pilcher & Johnson	936	0	0
W. C. Snow	949	0	0
Goode & Son....	883	13	0
G. Johnson....	876	0	0
Ratcliffe Bros.	835	5	0
G. Pavey	852	10	0
L. Shrubsole....	844	0	0
H. Tidy	838	17	0
A. Davis....	835	18	6
W. Judges....	789	0	0
Davis & Leaney	780	0	0
E. Fuller	747	0	0
Whiting Bros. (accepted)....	698	10	0

GAMSTON (Notts).—For alterations and additions to the Gamston Rectory, near Retford, Notts, for the Rev. W. J. Sparrow, M.A. Messrs. E. & F. Hewitt, architects and surveyors, Albert-square, Manchester:—

J. Robertson, Sheffield	£2,647	0	0
Lynam & Kidd, Nottingham	2,570	0	0
H. Vickers, Nottingham	2,450	0	0
J. Tomlinson & Sons, Sheffield	2,245	0	0
J. Fish, Retford	2,161	10	0
Chadwick & Co., Rotherham	2,100	0	0
R. Mettam, Retford (accepted)	1,814	15	0

GRAVESEND.—For the erection of a tavern in the Old Dover-road Gravesend, for Mr. Geo. Wood. Mr. W. Gould, architect, Gravesend:—

Blake	£879	0	0
Nightingale & Sons....	853	0	0
W. & E. Wallis....	830	0	0
Hill	829	0	0
Archer (accepted)	810	0	0
Rayfield (withdrawn, an error)	622	0	0

HULL.—For parochial offices, Sealcoates, Hull. Mr. Samuel Musgrave, architect, Hull:—

Jackson & Son	£1,970	0	0
Dalby & Son	1,647	15	0
Siminson	1,596	16	0
Good	1,581	10	10½
Harper....	1,571	0	0
Southern's Exors....	1,486	10	6
Ling	1,473	16	0
Hall	1,441	18	6
Blackburn	1,400	0	0
Goates	1,382	0	0
Drury	1,360	0	0
Freeman	1,341	15	8
Kendall*	1,336	14	0

* Conditionally accepted.

ISLINGTON.—For rebuilding the Chapel House public-house, Chapel-street. Messrs. Wilson, Son, & Aldwinckle, architects, East India-avenue, Leadenhall-street. Quantities supplied:—

Godden	£4,735	0	0
Staines & Son	4,572	0	0
Kirk & Randall....	4,493	0	0
Peto Bros.	4,463	0	0
Hearle	4,317	0	0
L. H. & R. Roberts....	4,247	0	0
Jackson & Todd	4,242	0	0
J. & H. Mills....	4,200	0	0
Perry & Co.	4,049	0	0
Shurmur (accepted)....	3,942	0	0

KING'S LYNN.—For the erection of new hotel and stables, at South Lynn, for Messrs. Eyre & Co. Mr. D. Clack, architect :—

W. Jarvis	£1,048 0 0
R. Dye	980 0 0
R. Fayers	973 0 0
Bardell Bros.	968 0 0
W. H. Brown	948 0 0
J. Leach (accepted)	938 0 0
P. H. Dawes	925 0 0

[All of King's Lynn.]

LEWISHAM.—For enlargement of the schools, Lewisham Bridge, for the School Board for London. Mr. T. J. Bailey, architect :—

Godfrey & Son	£2,208 0 0
Stephenson	2,166 0 0
H. L. Holloway	2,125 0 0
E. C. Howell & Son	2,096 0 0
F. & F. J. Wood	2,089 0 0
T. Oldrey	2,080 0 0
W. Shurmur	2,077 0 0
Patman & Fotheringham	2,070 0 0
Lathey Bros.	2,059 0 0
Scrivener & Co.	2,069 0 0
J. Grover & Son	2,053 0 0
Atherton & Latta	2,049 0 0
Wall Bros.	2,036 0 0
Kirk & Randall	2,030 0 0
Stimpson & Co.	1,993 0 0
J. E. Hunt	1,917 0 0
W. Johnson	1,888 0 0
S. J. Jerrard	1,883 0 0

LEWISHAM.—For the erection of new workroom for Mr. Oates, Lee High-road, Kent. Mr. H. T. Bonner, architect, High-street, Lewisham :—

Jerrard	£556 0 0
Robson	502 14 0
Kennard Bros. (accepted)	495 0 0

LONDON.—For erecting and completing St. George's House, Eastcheap. Mr. Delissa Joseph, architect, Basinghall-street :—

Perry & Co., Tredegar Works, Bow (accepted)	£21,250 0 0

NORTHAMPTON.—For the erection of a new Wesleyan School Chapel, with wood block-flooring, Kingsley Park, Northampton. Mr. H. H. Dyer, architect :—

Walls	£859 0 0
Ialip	780 0 0
Mitchel	739 10 0
Reynolds & Son	700 0 0
Ireson	589 0 0
Green Bros.	587 0 0
Dunkley	585 0 0
Woodford & Son	579 0 0
Hantin	577 0 0
Clayson Bros.	571 0 0
G. Fisher	570 0 0
Bassford	567 13 0
G. White	557 0 0
Hickman	553 0 0
J. B. Clark	550 0 0
Heap	545 10 0
Sonstar	534 0 0
G. Tompkins (accepted)	472 10 0

[All of Northampton.]

VAUXHALL.—For casing iron work, at Barrett & Co.'s factory, Bond-street, Vauxhall, with concrete. Mr. E. Rawlings, architect, Victoria-street, Westminster. Quantities supplied :—

F. Stent & Co.	£2,385 0 0
C. Drake & Co.	1,764 0 0
Hitchins & Co. (accepted)	1,374 5 6

WORTHING.—For building mortuary for the Worthing Local Board. Mr. Walter Horne, architect and town surveyor, Worthing :—

W. Stanbridge	£156 12 0
Bridger & Son	120 0 0
T. Stearn	103 7 0
A. Crouch	101 10 0
T. H. Churcher	100 0 0
Snewin & Son	97 10 0
C. C. Cook	96 15 0
J. Blaker	96 10 0
W. W. Sandell	94 10 0
J. Churcher	89 0 0
W. Churcher (accepted)	83 0 0

[All of Worthing.]

[Surveyor's estimate, £85.]

WEST HAM.—For the construction of a brick barrel intercepting sewer, 4 ft. 3 in. diameter and 865 ft. in length, for the West Ham Local Board. Mr. Lewis Angell, M.Inst.C.E., engineer, Town-hall, Stratford. Quantities by Messrs. R. L. Curtis & Son, London-wall, E.C. :—

	No. 1.	No. 2.
McKenzie & Anderson	£3,615 10	£2,971 5 0
Edmondson	3,058 12	3,786 12 6
T. M. Wisewell	2,780 0	3,480 0 0
L. Bottome	2,696 0	3,418 0 0
Botterill	2,679 0	3,145 0 0
W. Cunliffe	—	3,142 13 0
J. J. Robson	—	3,138 0 0
J. W. & J. Neave	2,656 0	—
B. Cook & Co., Battersea (accepted)	2,642 0	3,080 0 0
W. Nicholls	—	2,880 0 0

SPECIAL NOTICE.—Lists of Tenders frequently reach us too late for insertion. They should be delivered at our office, 46, Catherine-street, W.C., *not later than Four p.m.* on THURSDAYS.

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